Energy, Mines and Resources Canada

Énergie, Mines et Ressources Canada

CANMET

Canada Centre for Mineral and Energy Technology

Centre canadien de la technologie des minéraux et de l'énergie

Mining Research Laboratories

Laboratoires de recherche minière

Canada

CONCEPTUAL DESIGN OF BLIND RAISE BORING EQUIPMENT FOR DRIVING SHORT RAISES TO DEVELOP STOPES IN CANADIAN MINES

FINAL REPORT #4509

By

REDPATH ENGINEERING LIMITED

DATE OF ISSUE: 24 OCTOBER 1990

Work on this project was conducted under the auspices of the Department of Energy, Mines and Resources

DSS File Number: 003SQ.23440-9-9244
DSS Contract Number: 23440-9-9244/01-SQ
EMR Scientific Authority: J. Pathak

85 pp

MICROMEDIA

01/90T07

TABLE OF CONTENTS

SECTION	DESCRIPTION
1.0	INTRODUCTION
2.0	SCOPE OF WORK
3.0	CRITERIA AND ASSUMPTIONS
4.0	EXECUTIVE SUMMARY AND COMMENTARY
5.0	REDBORE 40 RAISE DRILL CAPABILITIES
6.0	REDBORE 40 ADAPTATION TO DOWNREAMING
7.0	MARKET SURVEY RESULTS
8.0	DRAWINGS
9.0	APPENDICES

SECTION 1.0

INTRODUCTION

1.0 INTRODUCTION

This report presents the results of the blindhole boring study prior to cancellation at the recommendation of Redpath Engineering Limited, of the blindboring segment of the study due to recent in field results and the acquisition of new information. Included is a discussion of the capabilities of the Redpath Redbore 40 Raise Drill (RB40), the modifications made to the RB40 to enable it to be utilized for downreaming as well as conventional raiseboring, and the results of a downreaming field test at a Canadian mining company. Also included is a discussion of the market survey which was sent to various mining companies across Canada to determine the potential demand for conventional raiseboring as compared to blindboring and downreaming.

For the purpose of this study raiseboring, downreaming and blindboring are defined as follows:

Raiseboring

In conventional raiseboring a pilot hole is drilled in a downwards direction to a breakthrough location and a cutting tool is used to increase the diameter of the pilot hole. The pilot hole is enlarged starting at the bottom of the pilot hole with the cuttings produced falling down the enlarged hole to the lower breakthrough point. Access to the bottom of the hole is required to enable the pilot bit to be removed from the end of the drill string and the reaming head to be attached.

Downreaming

Downreaming, or hole opening is similar to raiseboring with the exception that the pilot hole is enlarged starting at the top of the pilot hole with the cuttings produced falling down the pilot hole to the lower breakthrough point. In this method the reaming head is pushed towards the bottom of the pilot hole and access to the bottom of the pilot hole is not required.

Blind Boring

Blindhole boring is a method of mechanical excavation in which a reamer is used to bore a hole in a downward direction with or without a pilot hole lead. The term blind refers to the fact there is no access to the bottom of the hole for the removal of cuttings by gravity action and as result all cuttings produced must be removed in an upward direction to the hole collar location.

The purpose of the blindhole boring portion of the study was to identify the concepts necessary to enable the RB40 to be used for blindboring. This portion of the study was cancelled prior to its completion because a method (presently being patented) to remove cuttings form the hole was identified and has a good chance of success.

This came about as a result of Redpath being given the opportunity, prior to study completion, to bid on a number of blindholes for a civil construction project. The information on blindboring required for the bidding process was obtained from an outside consultant and because the process provided by the consultant was a proven one which could be readily adapted to the RB40, the study and associated costs on blindboring was no longer required.

SECTION 2.0

SCOPE OF WORK

2.0 SCOPE OF WORK

The scope of work included in this report has been revised from the original scope to reflect the work which was actually completed on the project. This includes:

- Identify the modifications required on the RB40 to enable the machine to be used for downreaming as well as raiseboring.

- Investigate the technology which is available for removing cuttings from the hole during blindboring and if a suitable method is not available, develop a theoretical method for cuttings removal for use with the RB40.

- Conduct a market survey to indicate the relative market demand for conventional raiseboring, downreaming and blindboring.

SECTION 3.0

CRITERIA AND ASSUMPTIONS

3.0 CRITERIA AND ASSUMPTIONS

The criteria and assumptions for the revised scope of work includes the following:

- All drawings will be conceptual engineering design drawings;
- The RB40 will be modified with modular components added for alternate drilling purposes. The main frame design characteristics of the unit will not be altered for application in this analysis;
- All units will be in the metric unit of measurement unless specified otherwise;
- All engineering designs are based on drilling in hard rock with the modified RB40.

SECTION 4.0

EXECUTIVE SUMMARY AND COMMENTARY

4.0 EXECUTIVE SUMMARY AND COMMENTARY

4.1 General

This section of the report summarizes the results of the blindboring study up to the change in scope of the project and the ultimate cancellation of the blindboring segment of the study.

Prior to the change in project scope, a market survey questionnaire was distributed to 84 mining companies across Canada to determine the potential demand for downreaming and blindboring. As well, the RB40 was modified to perform downreaming in addition to its original function of raiseboring for a downreaming field test at a Canadian mining company. The modifications made to the RB40 and the results of the downreaming field test and the market survey are summarized in this section and discussed in more detail in Sections 5.0 and 6.0 respectively.

During preliminary work on blindboring, Redpath Contracting was asked to submit a bid on a civil construction project requiring the excavation of a number of blindbored holes. In order for Redpath to submit the bid document in the required time frame, a method of cuttings removal had to be found to enable the RB40 to be converted into a blindboring unit, since this information was not available as yet from the study.

The cuttings removal process researched independently by Redpath Contracting and ultimately by an outside consultant was found to be acceptable to Redpath since the process was a proven one which would ensure its success in the particular application. Redpath could only obtain this information by signing a non-disclosure agreement because a patent application for the cuttings removal process was pending.

Since the information provided by the consultant rendered the blindboring segment of the study somewhat redundant, the decision was made by Redpath Engineering Limited to discontinue the study.

In a letter written to Ms. A. Humphreys, Redpath informed the Department of Energy Mines and Resources, Canmet - MRL Division of their decision.

4.2 Summary

Marketing Survey

The following conclusions were made as a result of analyzing the information provided in the completed market survey questionnaires. The overall response rate was favourable (46.4%) with 39 completed questionnaires returned out of the original 84 which were distributed.

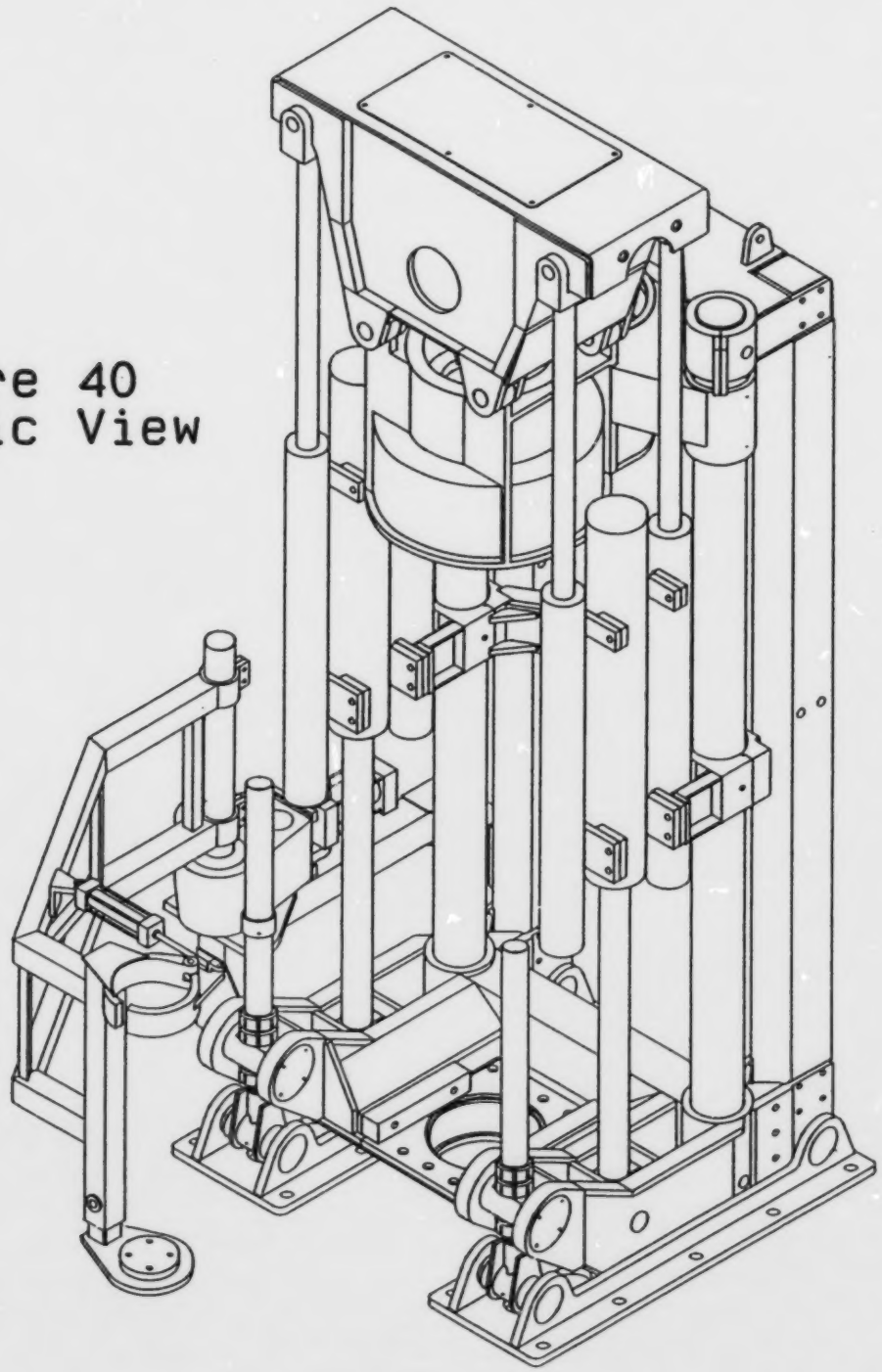
1) The majority of the mines (82%) do not have sufficient raiseboring, downreaming or blindboring work at a given mine to keep a modified RB40 busy on a continuous basis.

2) The potential demand for downreaming is much higher than for blindboring with 61.5% of the mines expressing an interest in downreaming and only 23.1% expressing an interest in blindboring.

3) The majority of the holes requiring downreaming are larger than 0.76 m (30 in.) diameter and cannot be downreamed with the modified RB40 using the standard machine set-up. A larger hole can be downreamed (up to 1.22 m diameter) if the machine set-up is modified to include an excavation under the machine, for introduction of the hole opener.

4) There is sufficient demand for a combination of raiseboring and downreaming to warrant continued interest in the modified RB40. To satisfy overall downreaming and raiseboring requirements a larger capacity machine than an RB40 is required.

Redbore 40
Isometric View



Conversion of the RB40 to Downreaming

The modifications listed below were necessary to enable the RB40 to perform downreaming as well as raiseboring. An isometric drawing of the RB40 is shown on the opposite page and an exploded view of the RB40 is included on the following page for reference.

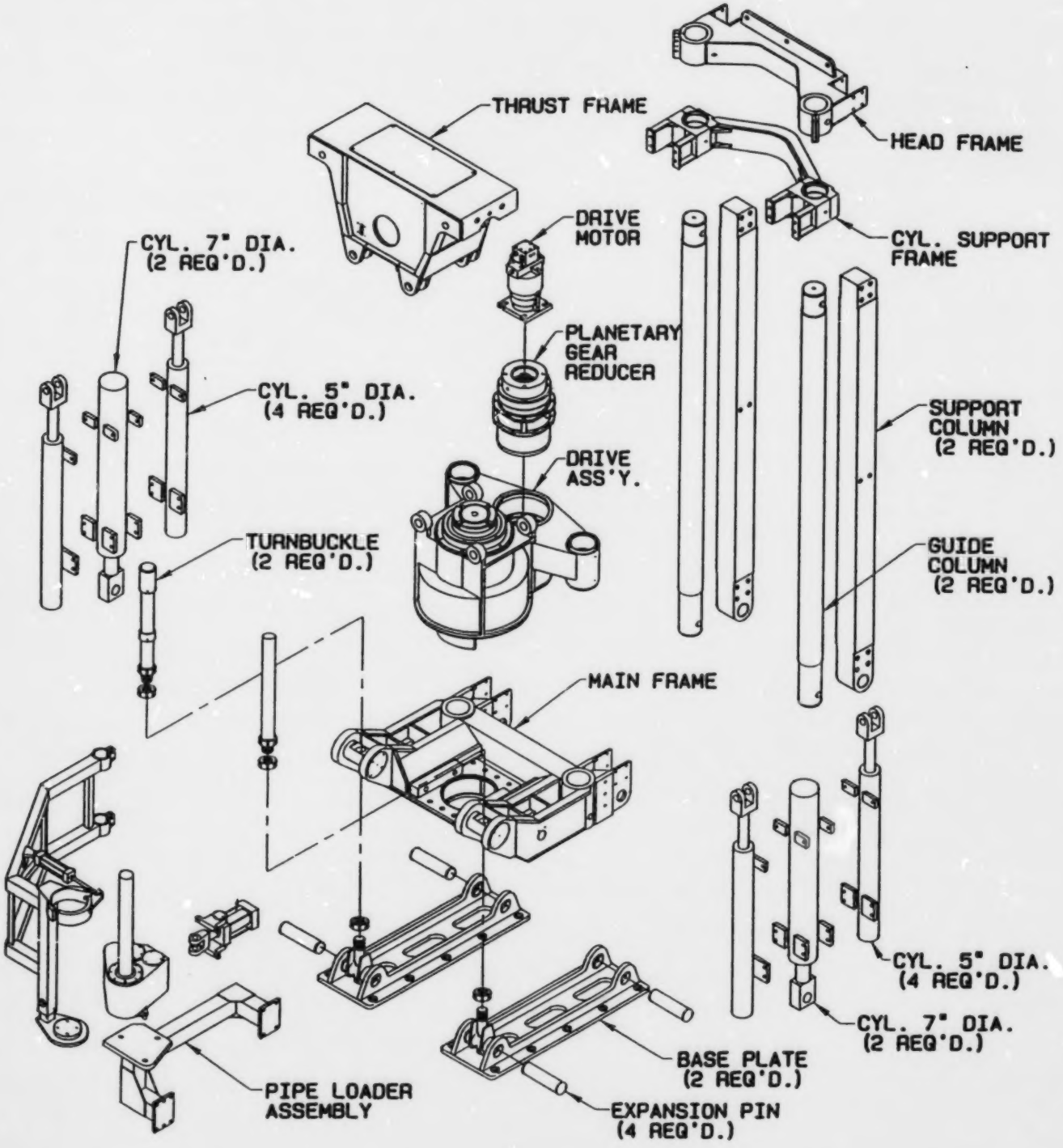
1) Machine Set-Up

The foundation and anchor bolt layouts for both the RB40 and modified RB40 are shown on Dwg. No. 40-0200 and Dwg. No. 40-13200 respectively. In the modified RB40 set-up, longer anchor bolts are required to ensure the anchor bolts do not pull out of the concrete/rock foundation when downreaming. The anchor bolts which hold the base plates of the RB40 to the concrete pad located below the machine must off set a higher downward thrust when downreaming than when pilot hole drilling. The size, number and spacing of the rebar remained unchanged from the standard RB40 machine set-up.

2) Raise Drill

The modifications to the raise drill centered on reworking the work table and the main frame to ensure the raise drill could still be used for raiseboring. The maximum diameter of the hole opener to be used for downreaming was established at 0.76 m (30 in.) in order to remain within the design limitations of the RB40.

The work table which is located in the central area of the main frame had to be redesigned to allow passage of the downreaming bit through the frame of the machine. This was accomplished by manufacturing the work table in two sections and incorporating a hinged arrangement in the design, that opens front to back to provide an opening of sufficient size through which the hole opener could pass. Drawings of the RB40 main frame assembly and work table prior to and after modification are included on Dwg. No's. 40-1300 and 40-13000 respectively. The modified



Redbore 40 Exploded View

work table was constructed of a 5.08 cm (2 in.) thick, high tensile strength steel plate with a lower reinforcing stiffener. This was necessary to ensure the work table was of sufficient strength to support the drill string and attached reamer when operating as a standard raise bore unit or when downreaming with the hole opener.

The only change to the main frame of the machine was the adjustment of the lower surface to increase the width between the base plates. The upper surface mounting arrangement for the column assemblies and thrust cylinders remained unchanged.

Downreaming Field Test

The results of the downreaming field test are summarized below:

° Test Location - No. 11 stope fill raise, 2350 Level

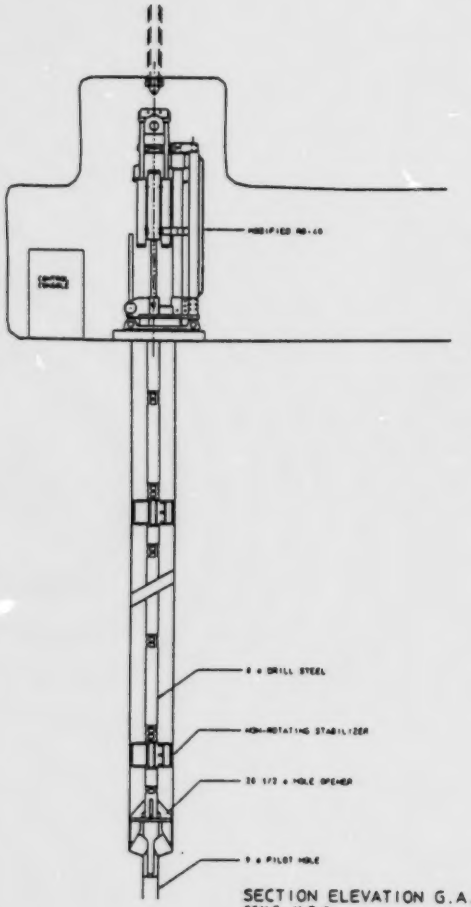
° Raise Statistics - Diameter - 0.72 m (28.5 in.)
- Length - 17.37 m (57 ft.)
- Angle - 90°

° Drilling Date - Start - 22 June 1990
- Completion - 23 June 1990

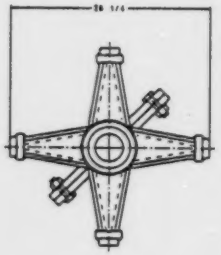
° Downreaming Set-up

The downreaming arrangement including the hole opener, the non-rotating stabilizers and the 20.32 cm (8 in.) drill string are shown on Dwg. No. 40-5133 on the following page.

The typical drill station arrangement is shown on Dwg. No. 40-13202.

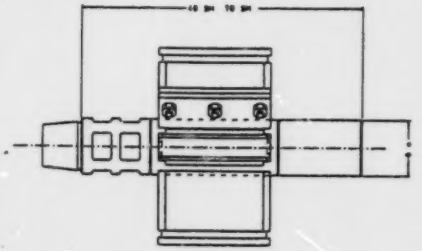


SECTION ELEVATION G.A.
SCALE: N.T.S.

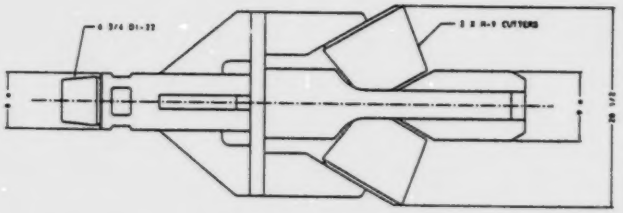


END VIEW

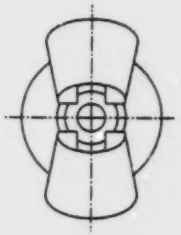
NON-ROTATING STABILIZER
40-5130
SCALE: 1/8 FULL



SIDE VIEW



SIDE VIEW



END VIEW

HOLE OPENER (28 1/2 ø)
40-5134
SCALE: 1/8 FULL

NOTE: 1. ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN INCHES UNLESS OTHERWISE NOTED.

NO	REVISIONS	BY	DATE	CK'D

125	COMMON MACHINING	MIXED OR FRACTIONAL ..... ± 1/32	
63	SMOOTH MACHINING	TWO PLACE DECIMAL ..... ± .010	
32	GRIND OR EQUAL	THREE PLACE DECIMAL ..... ± .005	
✓	DESCRIPTION	ANGLES ..... ± 1/2°	
FINISH SYMBOLS		TOLERANCES UNLESS SPECIFIED	

THIS DRAWING & ALL DATA THEREIN IS THE PROPERTY OF R.B. AMERICAN LTD. NORTH BAY, ONT., IS CONFIDENTIAL & MUST NOT BE COPIED IF IS LOANED SUBJECT TO RETURN UPON DEMAND & IS NOT TO BE USED IN ANY WAY DETRIMENTAL TO OUR INTEREST.

DRN	
DATE	20/03/90
CHKD	
DATE	
APPD	
DATE	

REDBORE 40

DOWN REAMING APPLICATION
DRILL STABILIZER, HOLE OPENER
AND G.A.

REDPATH RAISEBORING LIMITED

DATE	SCALE	DWG. NO.	REV.
MAR. '90	NOTED	40-5133	A

° Drilling Performance

Drilling time for the pilot hole, including hole collaring, totalled four hours with an average penetration rate of 4.34 m/h (14.25 ft./hr.)

Drilling time for downreaming totalled 8.9 hr. with an average penetration rate of 1.95 m/h (6.4 ft./hr.).

° Overview

The overall effectiveness of the hole opener cannot be adequately assessed on a single project due to the shortness of the hole.

Future cutter designs for the hole opener will incorporate a third cutter or use a four cutter configuration, rather than the two cutters used, to eliminate the machine vibrations which were likely due to the rough boring action of the two cutters.

° Future Plans

The production performance is seen as promising and the application of hole openers will continue to be pursued by our Contracting Division as an alternative excavation method.

4.0 SOMMAIRE ET COMMENTAIRES D'EXECUTION

4.1 Généralité

Cette partie du rapport résume les résultats de l'étude sur l'alésage à l'aveuglette jusqu'à la modification de la portée du projet et l'abandon définitive de la facette de l'étude sur l'alésage à l'aveuglette.

Avant la modification de la portée du projet, nous avions mené un sondage par la distribution d'un questionnaire auprès de 84 compagnies à travers le Canada dans le but d'établir le besoin potentiel d'alésage en descent et d'alésage à l'aveuglette. Bien que la RB40 ait été modifiée pour effectuer aussi bien l'alésage en descente, l'alésage à l'aveuglette que l'alésage en montée à l'aide d'un trou guide, selon sa vocation originale, dans un chantier minier canadien, les modifications apportées à la RB40 et les résultats de tests et d'études de marchés sont revus sommairement et discutés en détail dans les section 5.0 et 6.0 de ce rapport.

Au cours des travaux préliminaires sur l'alésage à l'aveuglette, Redbore Contracting a dû présenter une soumission sur un projet de construction nécessitant le forage d'une certaine quantité de trous requérant l'alésage à l'aveuglette. Afin de permettre à Redpath de soumettre sa soumission avant l'échéance établie, une méthode d'enlèvement de résidus résultant de cette nouvelle application de la RB40 en aléseuse à l'aveuglette devait être mise au point (inventée), cette connaissance n'est pas disponible au moment du sondage.

La recherche dans le procédé de récupération des résidus de forage à l'aveuglette, conduit séparément par Redpath Contracting et ultimement par une firme indépendante d'ingénieurs conseils c'est avérée acceptable par Redpath. La méthode s'étant prouvé d'un succès acceptable dans cette application particulière, Redpath s'est vue contrainte de signer une entent de non-révélation pour obtenir cette information afin de complaire à une attente de brevet en rapport avec la méthode du récupération des résidus d'alésage à l'aveuglette.

Etant donné que l'information diffusée par la firme d'ingénieurs conseils s'est avérée d'une certaine façon, futile, la décision de Redpath Engineering Ltd. fut de suspendre l'étude. A cet effet, une communication officielle à été signifiée au Ministère Energie Mines et Ressources et Canmet, Division MLR à M. S. Humphreys, par Redpath.

4.2 Sommaire

Sondage de mise en marche

Nous avons établi les conclusions suivantes, par les résultats complets d'analyses obtenus du questionnaire de mise en marche. D'un total de 39 questionnaires retournés, sur 84 soumis, un pourcentage majoritaire de réponses c'est avéré favorable (46.4%).

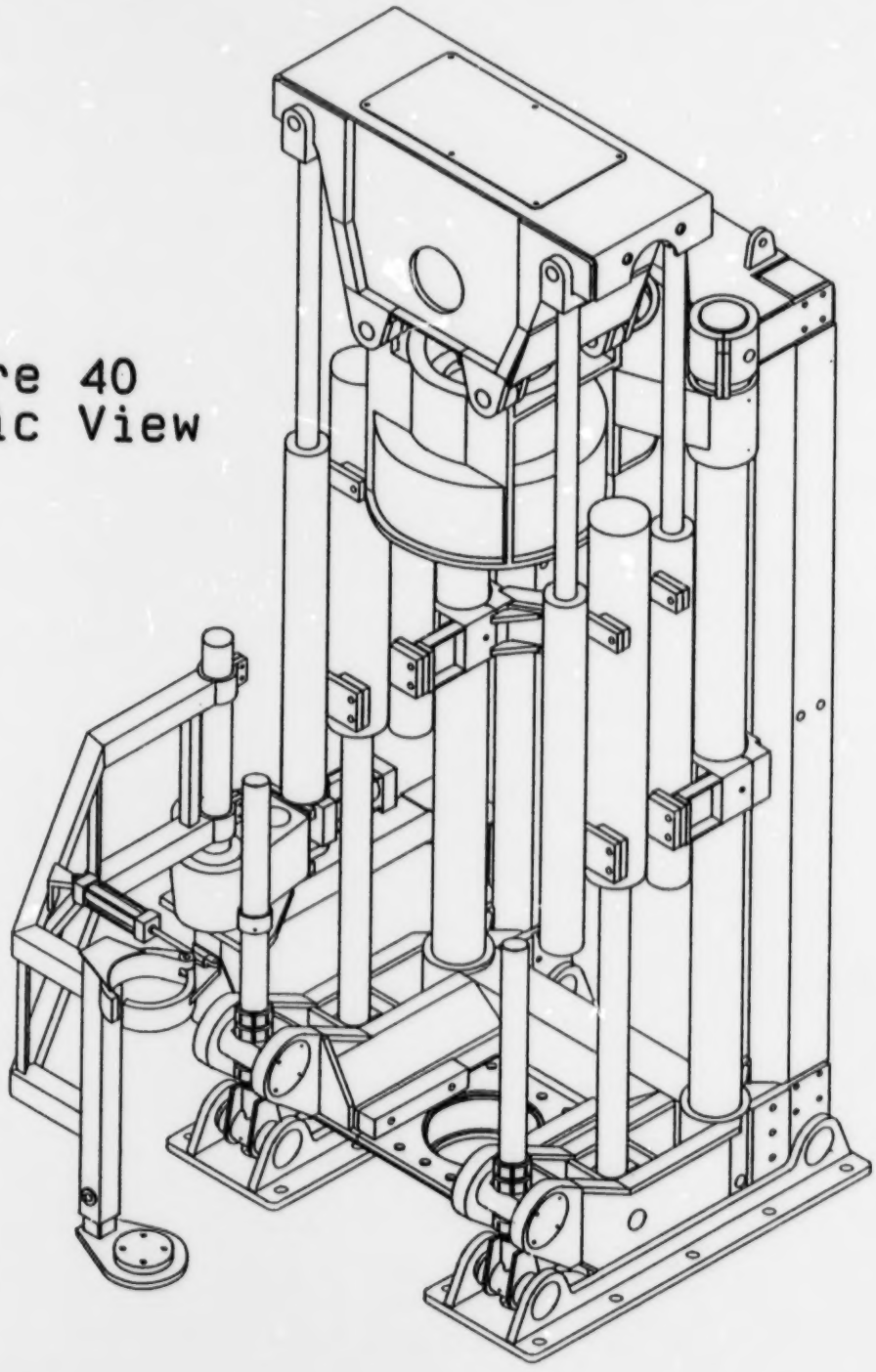
1) La majorité des mines (82%) n'ont pas un besoin suffisant de travaux d'alésage en montée, d'alésage en descente ou d'alésage à l'aveuglette dans un chantier particulier pour assurer l'utilisation d'une aléseuse RB40 à plein temps.

2) Le besoin potentiel d'alésage en descente est supérieur à l'alésage à l'aveuglette, avec un résultat des répondants de 61.5% des mines démontrant un intérêt pour l'alésage en descente comparativement à un intérêt de 23.1% pour l'alésage à l'aveuglette.

3) La majorité des besoins de dimension pour un alésage en descente sont supérieurs à 76 cm (30 pouces) de diamètre. Ces besoins ne peuvent pas être satisfaits par l'utilisation de la RB40 modifiée lorqu'utilisée avec son montage original. Un trou de dimension plus important peut être alésé en descente (jusqu'à 1.22 mètres) (48 pouces) si l'installation de la machine est modifiée de façon à prévoir une excavation sous l'aléseuse dans le but d'introduire le trépan d'alésage.

4) La demande est suffisante pour soutenir l'intérêt dans la promotion progressive de la RB40, autant dans l'utilisation

Redbore 40
Isometric View



d'alésage en montée que d'alésage en descente. Pour satisfaire la demande globale de besoins d'alésage en montée et/ou en descente, il nous faut, dès maintenant, prévoir la mise au point d'une aléseuse d'une performance supérieure au type RB40.

Modifications de la RB40 pour l'alésage en descente

Les modifications nécessaires à la RB40 pour devenir aussi efficace en alésage en descente que pour l'alésage en montée sont les suivantes:

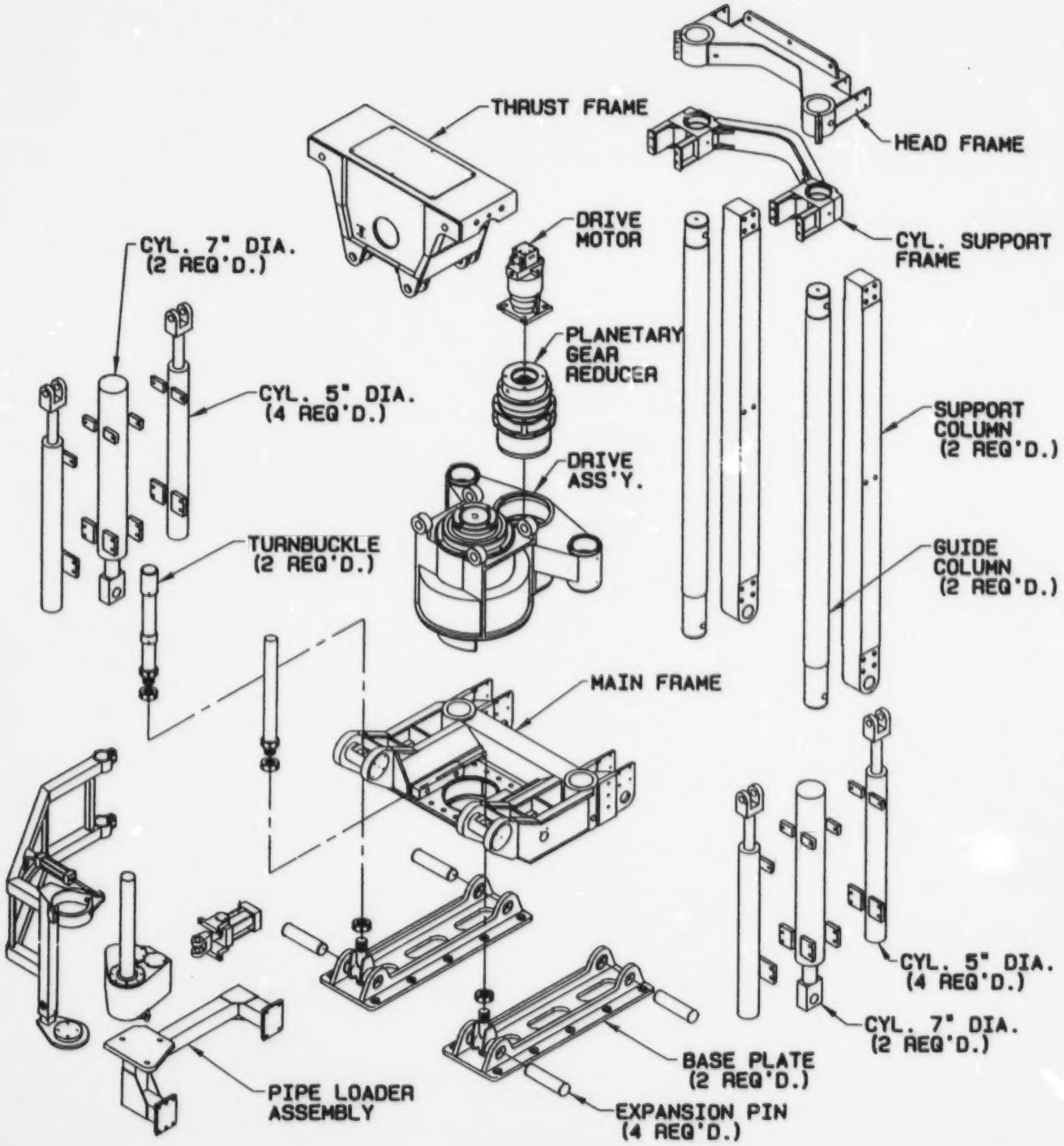
1) Mise en place de l'équipment.

Les dessins nos 40-0200 et 40-13200 démontrent respectivement les positions des fondations et des boulons d'ancrage pour l'installation de l'aléseuse RB40 modifiée. En ce qui concerne l'installation de l'aléseuse RB40 modifiée, les boulons d'ancrage se doivent être ancrés plus profondement dans le but d'assurer un ancrage à toutes épreuves, que ce soit dans le ciment ou la roche, au cours des opérations d'alésage en descente. Les boulons d'ancrage qui retiennent les plaques d'assises de l'aléseuse à la base, doivent guarantir une norme de résistance supérieure en opération d'alésage en descent que lors de forage de trou de guide. Il n'y a aucune différence de temps en rapport avec la dimension, le nombre ou la longueur des tiges entre la RB40 régulière et la RB40 modifiée.

2) La foreuse

La modification de la foreuse en montée a été limitée à refaire la table de travail et la bâti principal dans le but d s'assurer que la foreuse pourrait continuer de servir pour l'alésage en montée. Le diamètre du trépan à utiliser pour l'alésage en descente a été établi à 0.76 cm (30 pouces) de façon à respecter la limite de tolérance de la conception de la RB40.

La table de travail qui est située dans la partie centrale du bâti principal a dû être redessinée pour permettre le passage du trépan d'alésage en descente à travers le bâti de la machine. Ce travail a été réussi en fabriquant la table de travail en deux sections, en



Redbore 40 Exploded View

incorporant dans la conception un mécanisme à charnière qui s'ouvre vers l'arrière pour permettre une ouverture de dimension suffisante pour permettre le passage du trépan. Les dessins du bâti principal et de la table de travail assemblée avant et après la modification se retrouvent dans les dessins numéros 40-1300 et 40-13000 respectivement.

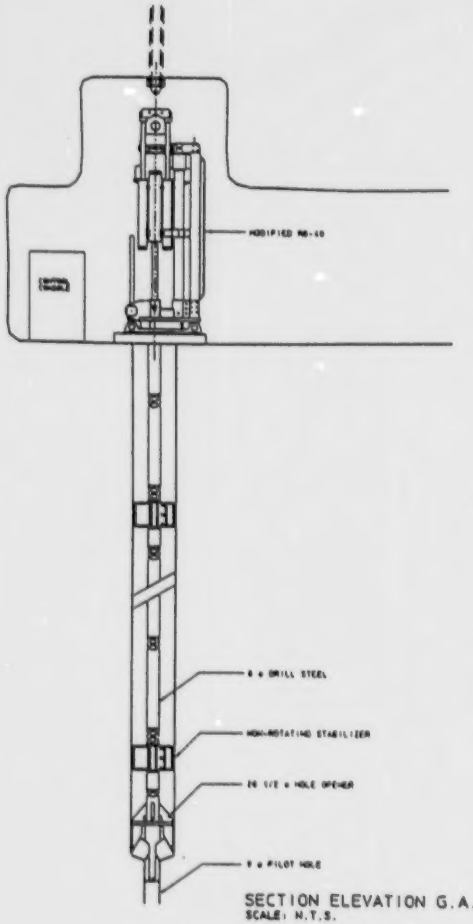
La table de travail modifiée a été fabriquée dans une plaque d'acier de haut résistance à la tension, d'une épaisseur de 5.08 cm (2 pouces) en y ajoutant un renfort inférieur. Il a fallu procéder ainsi pour assurer à la table de travail, la force nécessaire pour supporter la colonne de la foreuse et les fixations du trépan aussi bien pour l'alésage normal en montée qu'avec le trépan d'alésage en descente.

Le seul changement au bâti principal de la machine a été un adjustement de la partie inférieure pour augmenter la distance entre les plaques de fixation. La configuration de montage de la partie supérieure pour la colonne et les cylindres de pression demeurent inchangés.

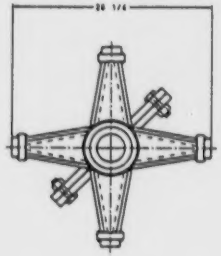
Résultats d'essai d'alésage en descente

Voici un sommaire des résultats d'un essai d'alésage en descente réalisé en chantier:

° Emplacement de l'essai	-	Chantier d'abattage remblayé no 11, niveau 2350	
° Données sur la cheminée	-	Diamètre:	0.72 m (28.5 pouces)
		Longueur:	17.37 m (57 pieds)
		Inclinaison:	90°
° Période des travaux	-	Debut:	22 juin 1990
		Fin:	23 juin 1990

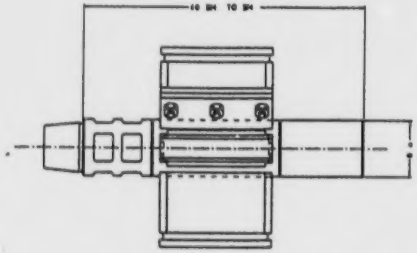


SECTION ELEVATION G.A.
SCALE: N.T.S.

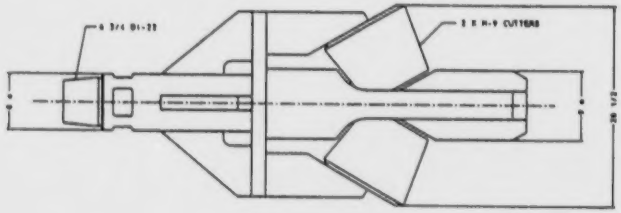


END VIEW

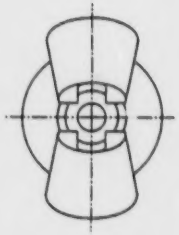
NON-ROTATING STABILIZER
40-5130
SCALE: 1/8 FULL



SIDE VIEW



SIDE VIEW



END VIEW

HOLE OPENER (28 1/2 ø)
40-5134
SCALE: 1/8 FULL

NOTE: 1. ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN INCHES UNLESS OTHERWISE NOTED.

NO	REVISIONS	BY	DATE	CK'D

125	COMMON MACHINING	WHOLE OR FRACTIONAL ..... ± 1/32	
63	SMOOTH MACHINING	TWO PLACE DECIMAL ..... ± .010	
32	GRIND OR SEAM	THREE PLACE DECIMAL ..... ± .005	
✓	DESCRIPTION	ANGLES ..... ± 1/2°	
FINISH SYMBOLS		TOLERANCES UNLESS SPECIFIED	

THIS DRAWING & ALL DATA THEREIN IS THE PROPERTY OF R.I. REDPATH LTD. NORTH BAY ONT. IT IS CONFIDENTIAL & MUST NOT BE COPIED, IT IS LOANED SUBJECT TO RETURN UPON DEMAND & IS NOT TO BE USED IN ANY WAY DETRIMENTAL TO OUR INTEREST.

DATE: 20/03/90

REDBORE 40

DOWN REAMING APPLICATION
DRILL STABILIZER, HOLE OPENER
AND G.A.

REDPATH RAISEBORING LIMITED

DATE	SCALE	DWG NO.	REV
MAR. '90	NOTED	40-5133	A

Le système d'alésage en descente qui comprend: le trépan, le stabilisateur fixe et la colonne de forage de 20.32 cm (8 pouces) sont montrés sur la page précédente le dessin numéro 40-5133.

Une installation typique est montrée par le dessin numéro 40-13202.

° Performance de forage

Le forage du trou guide incluant le collier du trou a duré 4 heures à une vitesse moyenne de pénétration de 4.34 m/h (14.25 pieds à l'heure)

L'alésage en descente a duré 8.9 heures à une vitesse moyenne de pénétration d 1.95 m/h (6.4 pieds à l'heure)

° Point de vue

L'efficacité globale du trépan ne peut être évaluée adéquatement par la réalisation de ce seul projet, dû à la faible longueur de trou.

La prochaine conception du trépan incorporera une configuration de trois ou quatre coupoirs, au lieu des deux utilisés, dans le but d'éliminer les vibrations de la machine qui étaient vraisemblement causées par l'action rude d'alésage du trépan à deux coupoirs utilisés.

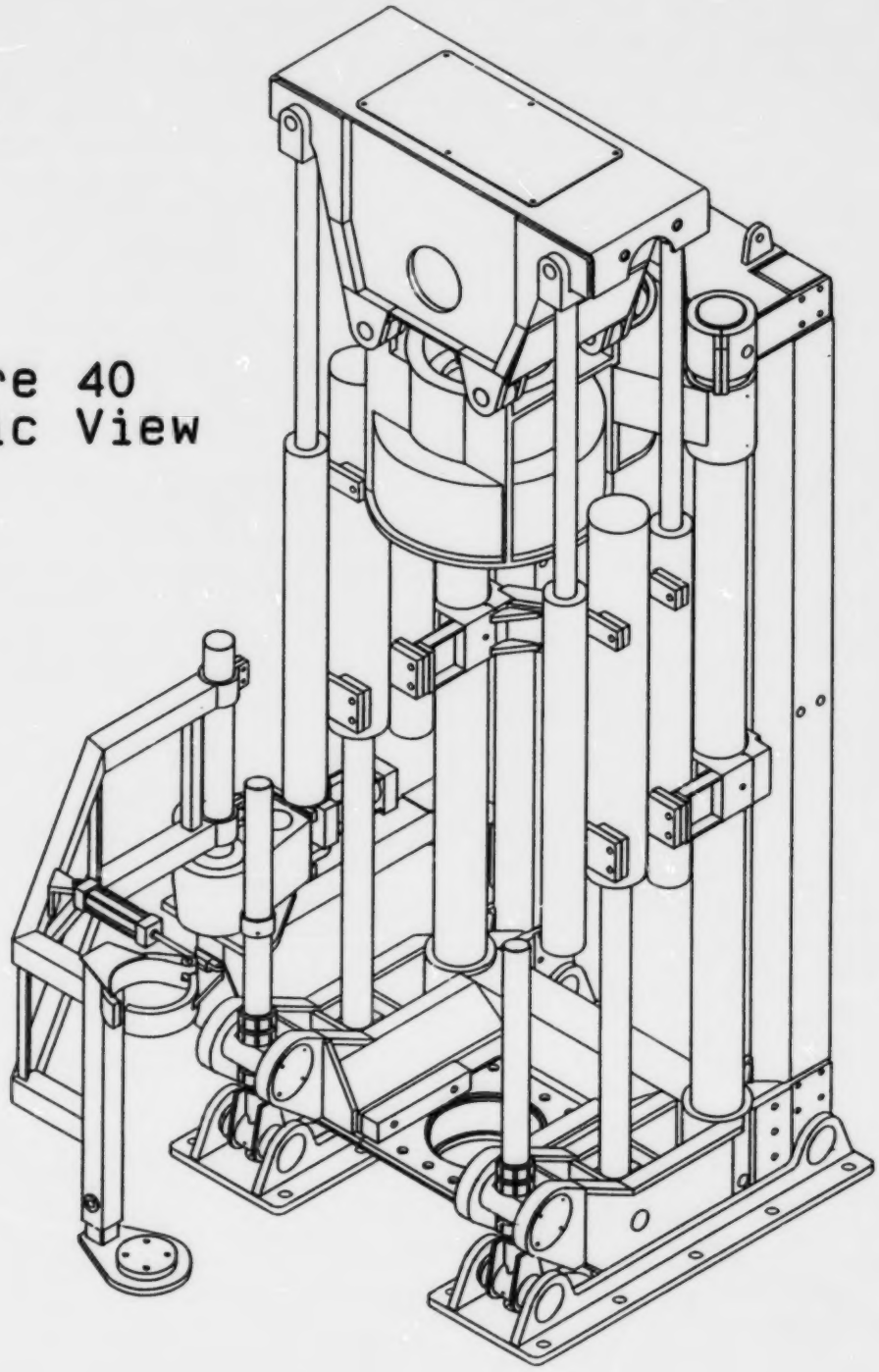
° Objectifs

La capacité de production prometteuse du trépan et son application se poursuivra par notre Division-Contrat en tant que méthode alternative d'excavation.

SECTION 5.0

REDBORE 40 RAISE DRILL CAPABILITIES

Redbore 40
Isometric View



5.0 REDBORE 40 RAISE DRILL CAPABILITIES

5.1 General

The Redbore Model 40 Raiseboring Machine is a compact and powerful drill designed specifically for excavating raises between mine levels. An isometric drawing of the raise drill is shown on the opposite page.

The following detailed information on the RB40 is included below as it formed the basis for review when considering its capability to down ream. Thus all components of the unit had to be checked to ensure they were structurally, mechanically and hyraulically capable of doing what was required. This information also aided in determining the size of the hole and its ultimate length in any future tests.

A complete operating package consists of three major assemblies, the raise drill, an electric/hydraulic pack and a remote control console. The station layout for limited access and for optimum setup and operation is illustrated on Drawings No. 40-0201 and 40-0202.

In the normal application, the machine is capable of raiseboring 1.22 m (4 ft.) diameter raises in high compressibility rock formations to a length of 121.92 m (400 ft.) The extended height of the derrick in a vertical position is 3.5 m (11.5 ft.) allowing for erection in mine drifts with minimal excavation costs. Construction is such that the entire machine can be completely disassembled to allow access through the smallest mine openings.

A raise is started by drilling a pilot hole with a 22.86 cm (9 inch) diameter bit from the upper to the lower level. At the breakthrough point the pilot bit is removed from the drill string and the reamer is attached. The reamer is pulled back towards the machine, opening the raise to its final diameter.

5.2 Specifications

The power requirements and specifications for the RB40 are summarized on the following tables, 5.1 and 5.2 respectively.

TABLE 5.1
REDBORE 40
POWER REQUIREMENTS

Electric	*550 to 600 V supply 3 phase @ 60 hz	
	Total Connected Load:	125 kV.A
	Main Motor - Starting Load:	600 kV.A
	74.5 kW (100 hp)	600 - 800 Amps maximum
	- Full Load:	95 kV.A
		96 Amps Maximum
Air	Pilot Hole Flushing: .377 m^3/s @ 551.58 - 689.48 kPa min. (800 cfm @ 80 - 100 psi minimum)	
Water	Pilot Hole Flushing: 9.46 L/s - 11.04 L/s @ 551.58 - 689.48 kPa minimum (150 - 175 gpm @ 80 - 100 psi)	
	Dust Suppression: 0.63 L/s @ 551.58 - 689.48 kPa minimum (10 gpm @ 80 - 100 psi)	

* Available voltage supply must be specified. Differing voltages require a compatible Main Motor and control transformer.

TABLE 5.2
REDBORE 40
SPECIFICATIONS

		Imperial	Metric
Raise Drill	Extended Height	138 in.	3505 mm
	Retracted Height	115 in.	2937 mm
	Transport Length	115 in.	2937 mm
	Transport Width	55.75 in.	1416 mm
	Transport Height	53 in.	1346 mm
	Weight	11,500 lb.	5216 kg
Thrust System	Type		Hydraulic Cylinders
	Maximum Pilot Hole Force (Recommended)	50,000 lb.	222 kN
	Maximum Reaming Force	230,000 lb.	1,023 kN
	Operating Pressure	3,000 psi	20,670 kPa
Rotation System	Type		Hydraulic Motor
	Pilot Hole RPM	0 - 120 variable	
	Pilot Hole Torque	*4,000 ft.-lb.	5.42 kN.m
	Reaming RPM	0 - 18 variable	
	Reaming Torque	*27,000 ft.-lb.	36.6 kN.m
	Maximum Torque (Break-out)	*42,000 ft.-lb.	56.9 kN.m
	Operating Pressure	3,200 psi	22,060 kPa
	Ultimate Pressure	5,000 psi	34,470 kPa

*Torque values calculated using 90% efficiency.

Performance	Pilot Hole	9 in. x 400 ft.	228 mm x 120 m
	Reaming	4 ft. x 400 ft.	1.2 m x 120 m
	Raise Angle		55° to Vertical

The performance specifications indicated on Table 5.2 relate to operational capabilities in predominantly harder [greater than 241318 kPa (35,000 psi UCS)] formations. Pilot hole drilling can be extended to over 182.88 m (600 ft.). Raises have been completed at 1.52 m (5 ft.) diameter to lengths of over 121.92 m (400 ft.) Site conditions will determine the maximum safe loading factors.

5.3 Operating Package

The Redbore 40 consists of three major assemblies; the raise drill, the electric/hydraulic power pack and the remote control console. A drill string and reamer are required for a complete operational package. A brief description of the major assemblies follows.

Control Console

The control console is the operating center for all machine functions. The console is skid mounted on a steel platform for portability. A tube frame provides mechanical protection. A chair with fore and aft adjustment mounted on a swivel base is included for operator comfort. The overall assembly dimensions are 78.74 cm (31 in.) wide by 147.32 cm (58 in.) high by 137.16 cm (54 in.) long. Total weight is approximately 295 kg (650 lbs.).

The console contains the switches, pushbuttons and meters needed by the operator for control and monitoring of machine functions. The meters are installed behind a Plexiglass viewing window for environmental protection. Operator devices are oil-tight for industrial use.

Power supplies, control relays, and circuit boards used to control the power pack directional valves and electro-hydraulic components are located in the console cabinet. The cabinet temperature is regulated with a thermostat and fan-forced heater. A test module is mounted on the interior of the base cabinet door and is used for monitoring of circuit board test points.

Two multi-pin cable assemblies connect the console to the power pack electrical cabinet. A third multi-pin cable connects to the speed sensor located in the raise drill gearbox. The sensor provides a signal to the RPM meter.

Electric/Hydraulic Power Pack

The power pack is the source of supply for all electrical and hydraulic circuits. The power pack consists of the electrical assembly, hydraulic assembly and lube oil assembly. The pack is skid mounted and constructed with high strength steel material. The overall dimensions are 104.14 cm (41 in.) wide by 110.49 cm (43.5 in.) high by 279.4 cm (110 in.) long. Total weight is approximately 2041 kg (4,500 lb.) Four lifting eyes are provided at each end of the pack for ease of handling. The pack can be lifted horizontally or slung vertically for access through small shaft compartments.

a) Electrical Assembly

Incoming power from the mine electrical service is terminated at the distribution block in the power connection box. From the power connection box power is fed to the electrical cabinet. The cabinet is located at one end of the pack and is recessed in the frame for mechanical protection. The main circuit breaker is operated with a door mounted handle mechanism. The mechanism prevents the cabinet door from being opened if the breaker is closed. The electrical cabinet contains all the necessary hardware for power distribution and motor control. A transformer supplies power to control circuits and convenience receptacles.

All electrical connections for control components on the power pack are made at the plug connection box. The use of multi-pin plug connectors greatly simplifies maintenance procedures when troubleshooting or replacing components. Connection to the remote control console is made with heavy duty multi-pin control cable assembles.

b) Hydraulic Assembly

The hydraulic system of the power pack includes all the components necessary for control of the raise drill functions. A hydraulic tank is mounted at the opposite end of the pack from the electrical cabinet. The tank has a capacity of 204.57 L (45 gal.) and is complete with a level/temperature gauge, breather, discharge shut off valves and return line fittings. A manually operated pump with an in-line filter is provided for filling the tank. Filtering the tank oil supply maintains system cleanliness and increases component life span.

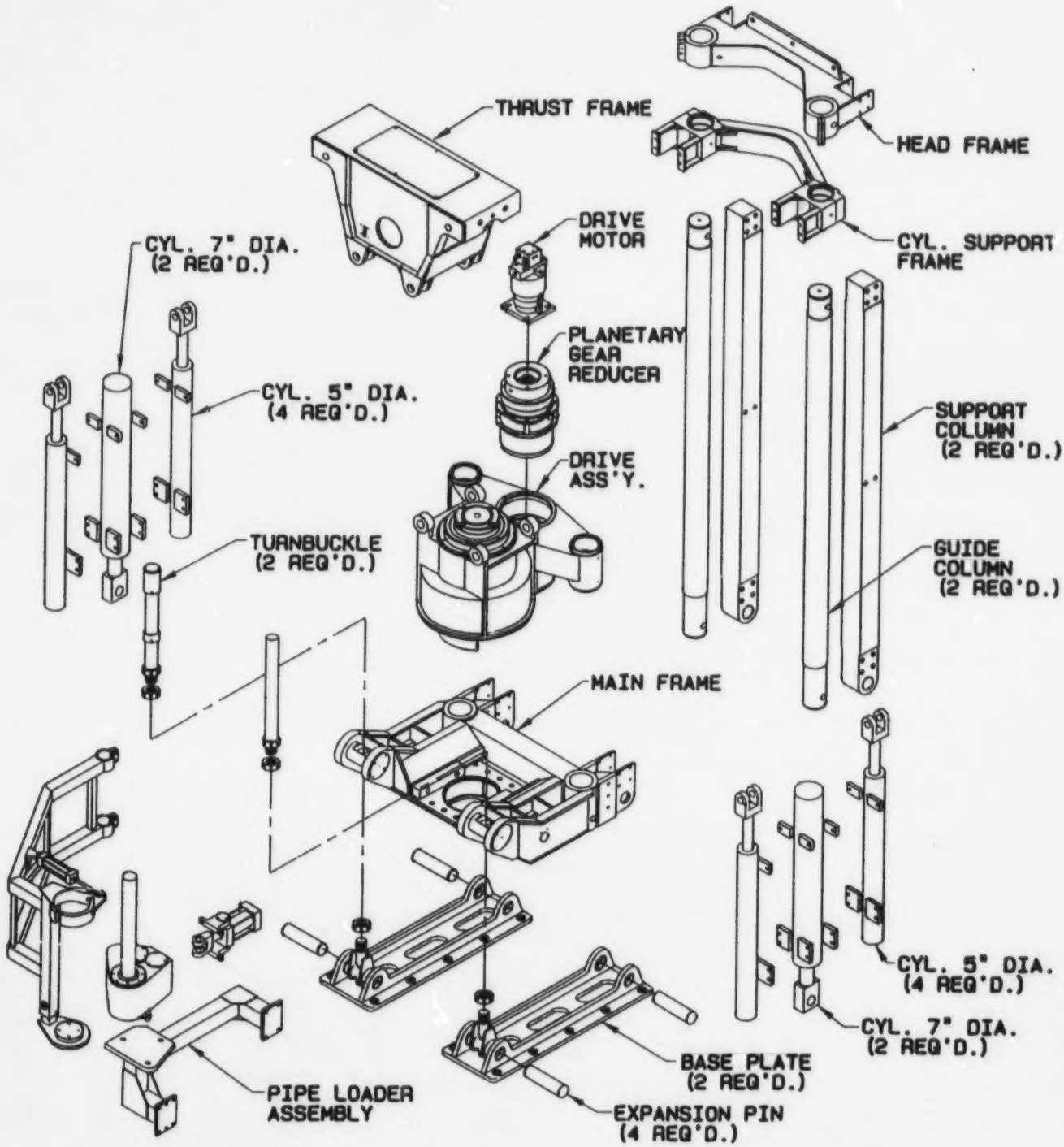
Filters and coolers for the hydraulic pumps are separately mounted on the pack. Two hydraulic pumps are used, flange mounted on either end of the 74.6 kW (100 hp) main motor. The pumps supply independent manifold and valve assemblies and serve different functions.

The cylinder pump is used to control the volume and pressure of the pipeloader clamp, pipeloader rotation and raise drill thrust cylinders. The pump has a maximum displacement of 2.27 L/s (30 gpm) and maximum pressure of 20684.4 kPa (3,000 psi).

The rotation pump is used to control the speed and pressure of the raise drill hydraulic motor. The pump has a maximum displacement of 4.09 L/s (54 gpm) and maximum pressure of 34474 kPa (5,000 psi).

Volume and pressure adjustment of both pumps is accomplished using electro-hydraulic components for greater reliability and accurate, precise control. All components used are rated for heavy industrial service and long life.

Hydraulic connection to the raise drill cylinders and motor is made with quick-connector hose assemblies.



Redbore 40 Exploded View

c) Lube Oil Assembly

The lube oil assembly is a self-contained closed loop system for lubrication of the raise drill gearbox. All components are located on the power pack. A flow meter provides indication of oil flow. Connection is made to the gearbox with two quick-connector hose assemblies.

Raise Drill

The raise drill supplies thrust and rotational forces to the drill string for pilot hole drilling and reaming. The raise drill general assembly is shown on Drawing No. 40-0100. An exploded diagram of the machine illustrating the major components and their relationship to each other is shown on the opposite page while a list of the component weights and dimensions are included on Table 5.3 on the following page.

TABLE 5.3
MAJOR COMPONENTS
WEIGHTS AND DIMENSIONS

ITEM	HEIGHT	WIDTH	LENGTH	DIAMETER	POUNDS WEIGHT
Baseplate	8.125	16.75	51	--	345 x 2
Turnbuckle	49	--	--	4.5	115 x 2
Expansion Pin	--	--	11	3.125	21 x 4
Main Frame	18	50	48.5	--	1,756
Pipeloader	37	28	45	--	670
Support Column	115	6	9.5	--	260 x 2
Guide Column	115	--	--	6	477 x 2
Cylinder Support Frame	6	23	48.75	--	265
Thrust Frame	27.75	20	48.75	--	715
Head Frame	10	18	49	--	267
Cylinder 7" (Bore)	57	--	--	8	395 x 2
Cylinder 5" (Bore)	55	--	--	6	220 x 4
Drive Assembly	23.25	38	47	--	2,817
Planetary Gear Reducer	22	--	--	14	405
Drive Motor	17.75	--	--	8.5	154
			Approximate Total		11,500

NOTE: All dimensions are in inches

SECTION 6.0

REDBORE 40 ADAPTATION TO DOWNREAMING

6.0 REDBORE 40 ADAPTATION TO DOWNREAMING

6.1 General

The Redbore 40 Raise Drill was designed as a "standard" boring machine, that is, the excavation sequence begins with a pilot hole drilled downwards followed by a reamer which is pulled upwards, to achieve the final hole excavation size. Of the various techniques in use today, this is the favoured method. With the standard sequence there must be an accessible lower breakthrough area for the pilot bit. This is to allow for the removal of the pilot bit and the attachment of the reamer.

Dependent on mine layout and stoping arrangements, there are occasions when access to an open area is not available or possible. This can be due to the absence of a suitable entry point, or to ground conditions where personnel are at risk from falling rock.

A number of mechanized boring techniques have been developed to overcome this problem. The basic raise drill can be configured and retooled to provide boxhole, blindhole or downreaming capabilities.

The boxhole excavation method is used to bore raises in an upwards direction from the machine without the use of a pilot hole, while a blindhole raise is bored downwards from the machine, again without the necessity of a pilot hole. Downreaming, on the other hand, is similar to standard raise boring in which a pilot hole is first drilled to a lower breakthrough area. Because the lower breakthrough area is inaccessible, the pilot hole is reamed by pushing the reaming head downwards starting from the top of the pilot hole rather than pulling the reamer upwards as in standard raise boring.

Neither the boxhole or the blindhole method has been developed to the point of universal acceptance as a readily applied excavation alternative.

The boxhole method is a very specific application and requires the use of expensive custom tooling and assemblies. Problems arise when attempting to apply high thrust loads against the reamer without causing severe drill string buckling in the bored opening. With the current developments, there are definite limits to the maximum raise length, typically not exceeding 45.7 m (150 ft).

The blindhole method can be accomplished using a standard raise drill. The problem is not with boring the rock formations, but with extracting the cuttings produced from the bored hole. There have been some recent successes with cutting extraction methods, but again with the use of expensive custom tooling and machinery.

The Redpath Group of companies has been involved in a number of machine developments to further the advance of economic mechanized excavation. This includes the design and manufacture of the RB40, as well as involvement with shaft and tunnel boring machines.

In order to expand the capabilities of the fleet of raise drills owned by Redpath Raiseboring Ltd., the downreaming method of excavation was seen as a viable alternative.

6.2 Downreaming Approach

To accomplish the downreaming function, a hole opener is used. A hole opener is a custom boring tool designed to follow an existing pilot hole. Unlike blindhole boring, a cutting extraction method is not necessary. All cuttings produced are flushed down the original pilot hole to the breakthrough area.

The downreaming project was initiated in February 1990 with the criteria listed below established as a guideline to identify the modifications required on the RB40 to enable it to perform downreaming:

- The maximum size hole to be downreamed was to be limited to the standard reaming capacity of the RB40 of 1.22 m (4 ft)

diameter by 121.9 m (400 ft) long holes at angles between 55° and vertical.

° The operational sequence of set-up and boring were to remain within established time limits for the standard applications with minimum modifications to the RB40.

° The RB40 raise drill was to be adapted and modified as necessary to provide the capability of boring with a hole opener to a maximum of 0.76 m (30 in.) diameter, since this is the largest size hole opener which can be fit through the main frame of the machine with minimum modifications to the RB40.

° Custom tooling was to be limited to the hole opener itself and special non-rotating stabilizers.

° The RB40, once modified, was to be capable of operation as a standard machine.

Using the foregoing criteria as a basis, the following modifications to the RB40 were identified:

Item	Required Modification(s)
Electric/hydraulic power pack	OK - No change required
Remote control console	OK - No change required
Raisedrill	
- Power requirements	OK - No change required
- Air requirements	OK - No change required
- Water requirements	OK - No change required
- Thrust system	OK - No change required
- Rotation system	OK - No change required

Item	Required Modification(s)
- Main frame/work table	The work table located in the central area of the main frame had to be redesigned to allow passage of the hole opener, used for downreaming, through the frame of the machine and also to provide suitable support for the weight of the drill string and attached reamer.
- Anchor system	The anchor system which attaches the baseplate of the RB40 to its concrete foundation had to be reviewed to ensure the anchor bolts were of sufficient strength to offset the higher downward thrust on the hole opener when downreaming as compared to pilot hole drilling.
Down Reaming Set-Up	
- 20.32 cm (8 in.) diameter drill rods	OK - No change required
- Non-rotating stabilizers	Stabilizers had to be installed at intervals along the drill rods to prevent lateral flexion of the drill string when downreaming. Stabilizers are not required in the standard raiseboring set-up.
- Hole opener	The hole opener which was used to perform the downreaming operation was restricted to a maximum diameter of .76 m (30 in.) to

Item	Required Modification(s)
Hole opener (continued)	minimize required design changes to the main frame of the raise drill. A larger hole opener of up to 1.22 m (4 ft) diameter could have been used, but only with major modifications to the RB40. The hole opener could also have been installed from the side of the machine into a suitable sized opening excavated under the machine but the operational sequence of set-up and boring would not remain within the established time limits for the standard application.

6.3 RB40 Modifications

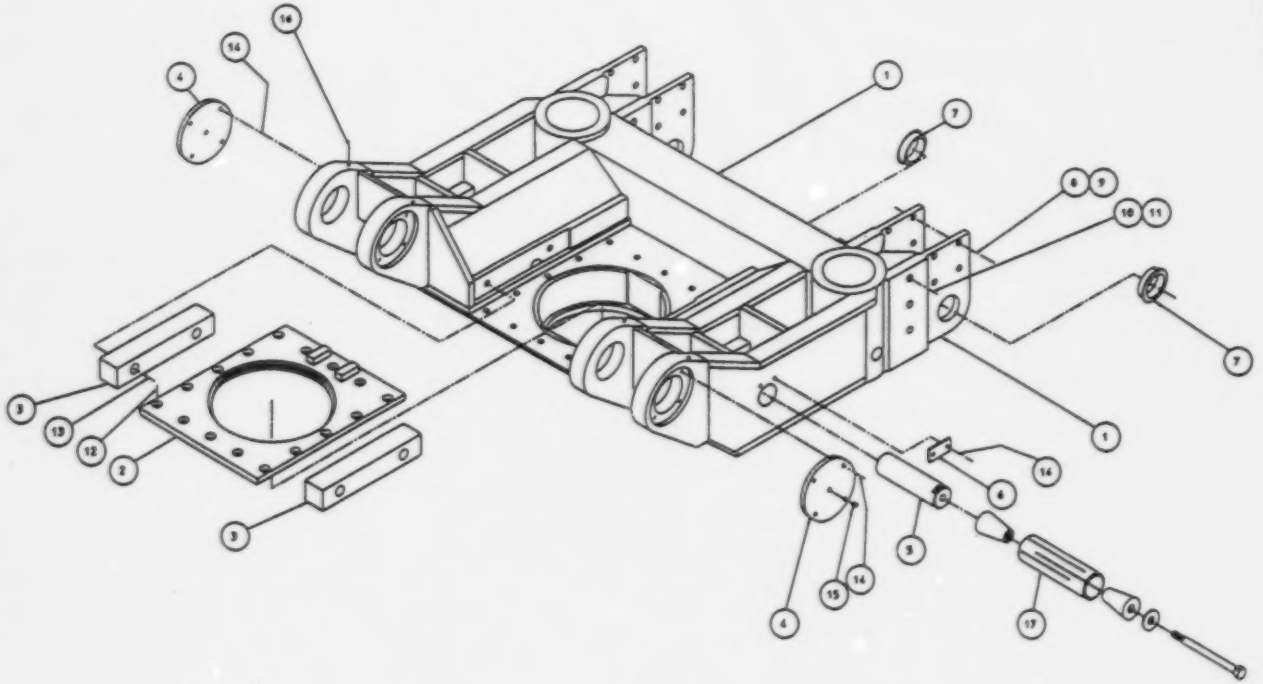
The decision to identify and carry out the modifications necessary to adapt the RB40 for downreaming and to test the adapted unit at its own cost was made by Redpath prior to implementation of the blindboring study. As a result, the majority of the modifications for downreaming were completed when the blindboring study began. Before the modified RB40 was tested, Redpath was approached by a Canadian mining company to downream a hole at one of their mines. This hole then become the test hole for the modified RB40.

The RB40 is configured for usage with 20.32 cm (8 in.) diameter drill rods. As a result, the clearances through the machine work table, main frame, and base plates were inadequate to permit the installation of a hole opener as part of a standard drill rod.

The base plates are anchored to the concrete pad with resin grouted rebar in the standard RB40 machine set-up, as shown on

ITEM	DESCRIPTION	PARTDWG. NO.	QTY.
1	MAIN FRAME WELDMENT	40-1301	1
2	WORK TABLE CHUCK PLATE	40-1302	1
3	WORK TABLE HEAD BAR	40-1303	2
4	RETAINER PLATE	40-1304	4
5	THRUST CYLINDER PIN (STANDARD)	40-1305	3
6	CYLINDER PIN LOCK PLATE	40-1306	2
7	PIVOT PIN BUSHING	40-1307	4
8	HEX. HEAD BOLT 3/8-16NC X 8 LG.		8
9	"NYLOCK" NUT 3/8-16NC		8
10	HEX. HEAD BOLT 3/4-10NC X 9 LG.		6
11	"NYLOCK" NUT 3/4-10NC		6
12	C/S SLOTTED HEAD MACHINE SCREW 3/8-16NC X 1 LG.		16
13	SOCKET HEAD CAP SCREW 3/4-10NC X 3 LG.		4
14	HEX HEAD MACHINE SCREW 3/8-16NC X 1 LG. GR. 5		20
15	SET SCREW 1/2-13NC X 1/2 LG.		2
16	STRAIGHT GREASE FITTING 1/8 NPT		4
17	THRUST CYLINDER EXPANSION PIN (OPTIONAL)	40-1309	2

NOTE: ALL BOLTS, NUTS AND SCREWS TO BE SAE GRADE 8 UNLESS OTHERWISE NOTED.



NO	REVISIONS	BY	DATE	CK'D
	ADDED OPTIONAL CYLINDER EXPANSION PIN	EJH	06/98	

125	CERMET MACHINING	SINGLE OR FRACTIONAL..... ± 1/32	
63	SMOOTH MACHINING	TWO PLACE DECIMAL..... ± .010	
32	GRIND OR SEAL	THREE PLACE DECIMAL ..... ± .005	
✓	DESCRIPTION	ANGLES ..... ± 1/2°	
FINISH SYMBOLS		TOLERANCES UNLESS SPECIFIED	

THIS DRAWING AND ALL DATA THEREIN IS THE PROPERTY OF [illegible] AND SHALL NOT BE COPIED, IN WHOLE OR IN PART, OR LOANED OR DISCLOSED TO ANYONE WITHOUT THE WRITTEN CONSENT OF [illegible]

DWG. NO. 40-1000

EJH

DATE 06/07/00

REDBORE 40

TITLE MAIN FRAME ASSEMBLY ISOMETRIC VIEW

REDPATH MANUFACTURING
A Division of the JD Redpath Group of Companies

DATE APR. '00 | SCALE N.T.S. | DWG. NO. 40-1300 | REV. A

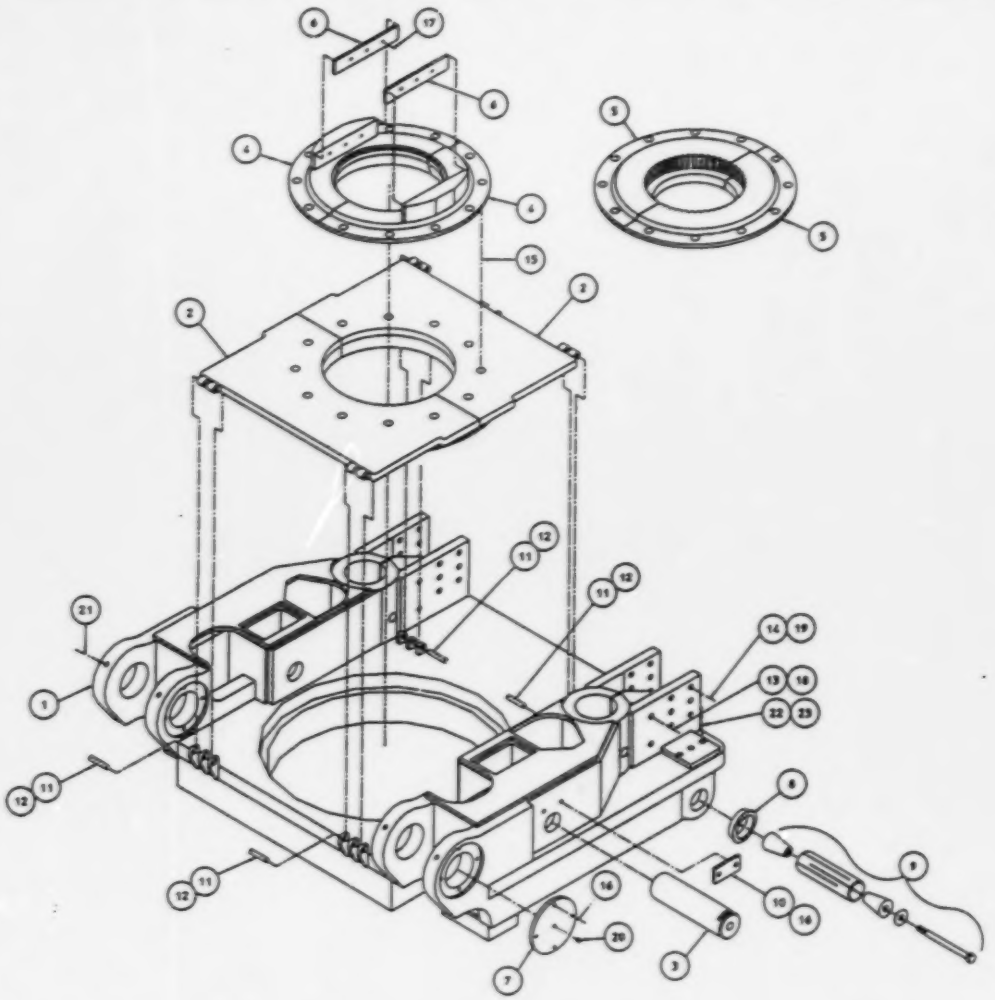
Dwg. No. 40-002. With the higher downward thrust on the hole opener when downreaming as compared to the thrust on a 22.86 cm (9 in.) tricone bit when drilling a pilot hole, the clamp load on the base plates to the concrete pad had to be increased. This was accomplished in a relatively simple manner by using the same diameter rebar to a greater inserted depth as shown on Dwg. No. 40-13200.

The specific problem areas that arose were due to the project criteria of installing the hole opener onto the drill string as a standard component. The distance between the base plates would not allow a 0.76 m (30 in.) diameter tool to be inserted through the base plates into the rock formation.

The main frame of the RB40 is a fabricated assembly designed with a lower surface to mate with the base plates as shown on Dwg. No. 40-1300 on the opposite page. The upper surface is fitted with welded plate assemblies to permit installation of the machine guide and support columns and thrust cylinders. The centre of the main frame is bridged with the work table. The work table is normally supplied with a 34.29 cm (13.5 in.) diameter hole to allow passage of a drill rod. The work table is a critical component in that it must also withstand the weight of a drill string when a drill rod is wrenched for installation and removal procedures.

Fortunately, the clearance between the thrust cylinders and column assemblies is greater than 0.76 m (30 in.). These distances could not have been increased due to the manner in which the various sub-assemblies are keyed together.

Following a comprehensive design study, the machine modifications centred on reworking the work table and main frame. The main frame lower surface was adjusted to increase the width between the base plates. The upper surface mounting arrangement for the column assemblies and thrust cylinders was duplicated exactly.



ITEM	DESCRIPTION	PART/DWG.No.	QTY.
1	MAIN FRAME WELDMENT	40-13001/40-13001	1
2	RAISED WORK TABLE	40-13002/40-13002	2
3	CYLINDER PIN	40-13003/40-13003	2
4	WORK TABLE INSERT (STANDARD)	40-13004/40-13004	1
5	SPLINED WORK TABLE INSERT (OPTIONAL)	40-13005/40-13005	1
6	WRENCH BAR WEAR PLATE	40-13006/40-13006	2
7	GUSSET PLATE	40-1304/40-1302	4
8	PIVOT SUBBASE	40-1307/40-1302	4
9	BASE PLATE EXPANSION PIN ASSEMBLY	40-13700/40-13700	4
10	CYLINDER PIN LOCK PLATE	40-1306/40-1302	2
11	CLEVIS PIN 1 o.d X 6 1/2 LG.	40-13607/40-13607	4
12	HITCH PIN (SPHC-HAIR CP-72H OR SIMIL)		4
13	HEX. HEAD BOLT 3/4-10UNC X 2 LG.		4
14	HEX. HEAD BOLT 3/4-10UNC X 2 LONG		12
15	HEX. HEAD MACHINE SCREW 1-8UNC X 1 1/2 LG.		12
16	HEX. HEAD MACH.SCREW 3/8-16UNC X 1/2, GR.5		20
17	C/SUNK MACH.SCREW 3/8-16UNC X 3/4 LG.		4
18	NYLOCK HEX. NUT 3/4-10UNC		4
19	NYLOCK HEX. NUT 3/8-16UNC		12
20	SET SCREW 1/2-13UNC X 1/2 LG.		2
21	STRAIGHT GREASE FITTING 1/8 NPT		4
22	HEX. HEAD CAP SCREW 3/8-11 UNC X 1 1/2 LG.		4
23	HELICAL SPRING LOCK WASHER 3/8in		4

NOTE: 1. ALL BOLTS, NUTS AND SCREWS TO BE SAE GRADE 8 OR BETTER UNLESS OTHERWISE NOTED.

NO	REVISIONS	BY	DATE	CK'D

125	COMMON MACHINING	WHOLE OR FRACTIONAL ..... ± 1/32
63	SMOOTH MACHINING	TWO PLACE DECIMAL ..... ± .010
32	GRIND OR SIMIL	THREE PLACE DECIMAL ..... ± .005
✓	DESCRIPTION	ANGLES ..... ± 1/2°
FINISH SYMBOLS		TOLERANCES UNLESS SPECIFIED

THIS DRAWING & ALL DATA THEREIN IS THE PROPERTY OF T.S. REDPATH LTD. NORTH BAY ONT. - CANADA CONFIDENTIAL & MUST NOT BE COPIED, LENT OR DISCLOSED SUBJECT TO RETURN UPON DEMAND & IS NOT TO BE USED IN ANY WAY DETRIMENTAL TO OUR INTEREST

40-13100

REDBORE 40

DOWN REAMING APPLICATION
MAIN FRAME GEN. ASSEMBLY
ISOMETRIC DRAWING

REDPATH RAISEBORING LIMITED

APR. '90 | N.T.S. | 40-13000

The majority of engineering and design work was concentrated on the centre of the main frame and the work table. The most practical means of installing the hole opener from a conceptual standpoint was by manufacturing the work table in two sections and installing the assembly with a hinged arrangement as illustrated on Dwg. No. 40-13000 on the opposite page.

Using 5.08 cm (2 in.) thick high tensile strength steel plate with a lower reinforcing stiffener ensured that the weight of a 152.4 m (500 ft.) long drill string and attached reamer was within a recommended factor of safety. This would allow the machine to operate with the hole opener or as a conventional machine.

The work table sections were installed with hinges opening front to back. In this manner, the table sections could be opened when the travelling gearcase housing of the machine was at the top of the thrust cylinder stroke.

Opening of the table sections permits the hole opener, after being threaded to the chuck of the machine, to be lowered into position below the main frame to allow the work table sections to be reclosed.

The centre of the work table is machined and fitted with threaded holes to accept a work table insert. The insert is machined to accommodate the drill rod wrenches. As with the work table itself, the insert was manufactured in two halves. In order to act as a stiffener and improve the load retention capabilities of the design, the insert halves are fastened to the work table sections at right angles to the work table centre dividing line.

6.4 Installation of Modified Assemblies

The changeover from the standard to the modified work table was accomplished in the field.

The changeover was basically trouble free other than a few minor interference problems between the new assemblies and the existing

structure. Time to convert the machine totalled approximately 120 man hours.

6.5 Downreaming Field Test

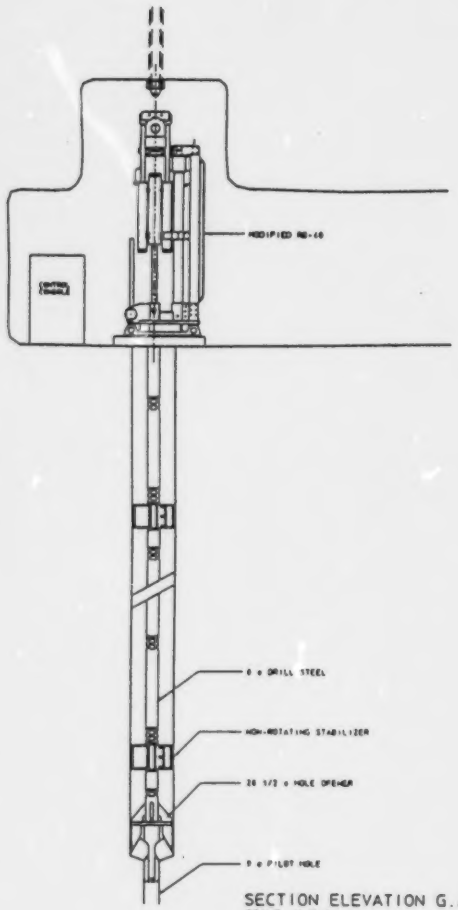
The downreaming field test of the modified RB40 raise drill was undertaken from June 19 to June 23, 1990 at a Canadian mining company. Related test data is indicated below:

Project Number:	512
Location:	2350 Level, No. 11 Stope Fill Raise
Diameter:	0.72 m (28.5 in.)
Length:	17.37 m (57 ft.)
Drill Angle:	90°
Machine Number:	RB40-001

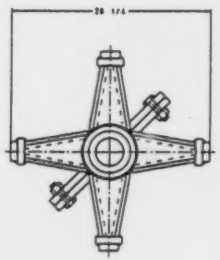
The purpose of the raise to be downreamed was for the insertion of fill into the No. 11 stope on 2350 level as part of the normal mining activity. The diameter chosen for the hole opener of 0.72 m (28.5 in.) was adequate for this purpose, although a hole of up to .76 m (30 in.) diameter could have been downreamed.

Following the RB40 changeover, the machine was anchored and set up at the designated location. The typical station layout for performing the downreaming work is shown on Dwg. No. 40-13202. Normal drilling procedures were used for the 22.86 cm (9 in.) diameter x 17.37 m (57 ft.) pilot hole. Start date for the pilot hole was June 22, 1990. The pilot hole drilling time, including hole collaring, totalled 4 hours. Over the 17.37 m (57 ft.) length, this resulted in an overall pilot rate of penetration of 4.34 m/h (14.25 ft./hr.). The average weight placed on the bit, over the length of the pilot hole, from the drillers logsheet was 178 kN (40,000 lb.) thrust.

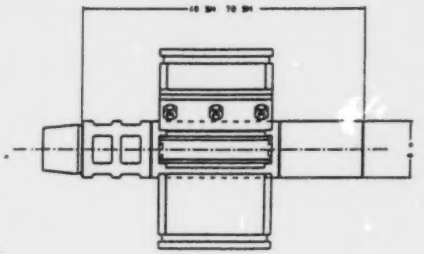
The downreaming phase of the project was started after the drilling of the pilot hole on June 22 and completed by the following day. The downreaming setup, including drawings of the hole opener, the



SECTION ELEVATION G.A.
SCALE: N.T.S.

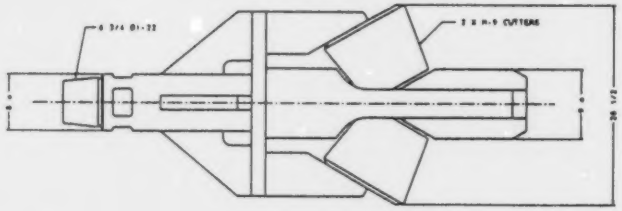


END VIEW



SIDE VIEW

NON-ROTATING STABILIZER
40-5130
SCALE: 1/8 FULL



SIDE VIEW

END VIEW

HOLE OPENER 126 1/2 ø1
40-5134
SCALE: 1/8 FULL

NOTE: 1. ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN INCHES UNLESS OTHERWISE NOTED.

NO	REVISIONS	BY	DATE	CK'D
1				
2				
3				
4				

FINISH SYMBOLS		TOLERANCES UNLESS SPECIFIED
125	COMMON MACHINING	WHOLE OR FRACTIONAL..... ± 1/32
63	SMOOTH MACHINING	TWO PLACE DECIMAL..... ± .010
32	GRIND OR EQUAL	THREE PLACE DECIMAL .... ± .005
✓	DESCRIPTION	ANGLES ..... ± 1/2°

THIS DRAWING & ALL DATA THEREIN IS THE PROPERTY OF J.D. REDPATH LTD., NORTH BAY, ONT. IS CONFIDENTIAL & MUST NOT BE COPIED. IT IS LOANED SUBJECT TO RETURN UPON DEMAND & IS NOT TO BE USED IN ANY WAY DETRIMENTAL TO OUR INTEREST.

DRAWN BY: DBH
DATE: 20/03/90

REDBORE 40

DOWN REAMING APPLICATION
DRILL STABILIZER, HOLE OPENER
AND G.A.

REDPATH RAISEBORING LIMITED

DATE: MAR. '90 | SCALE: NOTED | DWG NO.: 40-5133 | REV: 1

non-rotating stabilizers and the 20.32 cm (8 in.) diameter drill string are shown on Dwg. No. 40-5133 on the opposite page.

The hole opener tool was equipped with two standard reamer carbide cutters and flushing nozzles to force the cuttings down the pilot hole. The non-rotating stabilizers were spaced a distance of 8.53 m (28 ft.) apart along the drill rod string to prevent lateral flexion of the drill rods as the hole opening progressed.

The average thrust load on the hole opener was slightly over 178 kN (40,000 lb.) per cutter. Over the hole length, the rate of penetration was 1.95 m/h (6.4 ft./hr.) with a total drilling time of 8.9 hours.

6.6 Overview of the Downreaming Test

It is difficult to estimate the overall potential or effectiveness of the hole opener based on a single project. The short pilot hole length did not allow any experimentation with varying loads and speeds of rotation.

Some minor problems were experienced with the drill string and machine vibration during the hole opening operation, probably due to the rough boring action of the two cutters. Future designs will incorporate a third cutter or use a four cutter configuration to provide a smoother operation.

The production performance is seen as promising and the application of hole openers will continue to be pursued as an alternative excavation method.

SECTION 7.0

MARKET SURVEY RESULTS

7.0 MARKET SURVEY RESULTS

A market demand survey questionnaire was prepared and distributed in May 1990 to 84 mining companies across Canada. A sample copy of the questionnaire which was distributed and a list of the companies contacted is included in Appendix 1. The purpose of the survey was to determine the potential demand for downreaming and blindboring in order to assess the benefit of converting the RB40 raise drill into a unit capable of performing downreaming and/or blindboring as well as its original raiseboring function.

The response to the marketing questionnaire was favourable with 39 completed questionnaires returned out of the original 84 which were distributed giving an overall response rate of 46.4%.

The following conclusions/observations were made as a result of analyzing the information in the marketing questionnaire:

(1) The majority of mines do not have sufficient raiseboring, downreaming and blindboring requirements to keep the RB40 raise drill busy on a continuous basis. Only 7 out of a total of 39 mines or 18% had sufficient raiseboring work to warrant purchase of an RB40 or equivalent size raisebore unit.

(2) A total of 20 mines or 51% required raise excavations with a raiseborer machine with the balance of mines (49%) utilizing other raise excavation methods. Approximately 65% of the raiseborer excavations were for openings of 1.52 m (5 ft.) diameter or less with 35% of the raise excavations having a diameter between 1.52 m (5 ft.) and 3.65 m (12 ft.).

(3) The potential demand for downreaming is much higher than the demand for blindboring. A total of 61.5% of the mines were interested in downreaming and 23.1% were interested in blindboring, with the balance of 15.4% not interested in either method.

(4) The main purpose of the holes requiring downreaming is for filling old stopes and slot raising above old stopes.

(5) The following data was provided by the mines in regards to potential downreaming work:

- Hole Requirements - Average - 18 holes per year
  - Range - 1 to 60 holes per year
- Hole Size - Average - 1.37 m (4.5 ft.) diameter
  - Range - 0.30 m (1 ft.) to 2.44 m (8 ft.) diameter
- Hole Length - Average - 45.72 m (150 ft.)
  - Range - 21.34 m (70 ft.) to 121.92 m (400 ft.)
- Hole Dip - 45° to 90°

Based on the hole size requirements for downreaming noted above, a larger capacity machine than an RB40 would be required to excavate a large proportion of the holes.

As well, the average hole requirement of 18 holes per year (1.5 holes per month) is quite low and as a result downreaming may not be cost competitive with other raise excavation methods in a given mine.

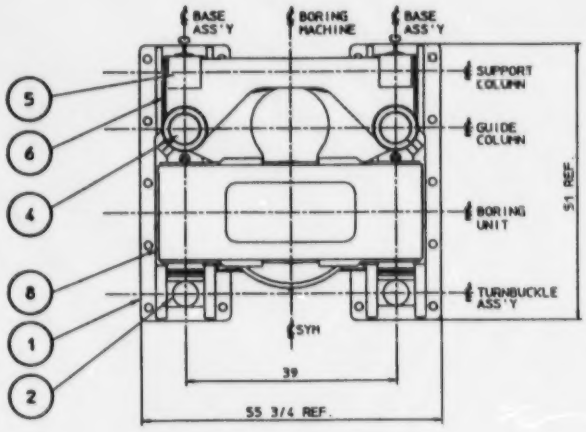
SECTION 8.0

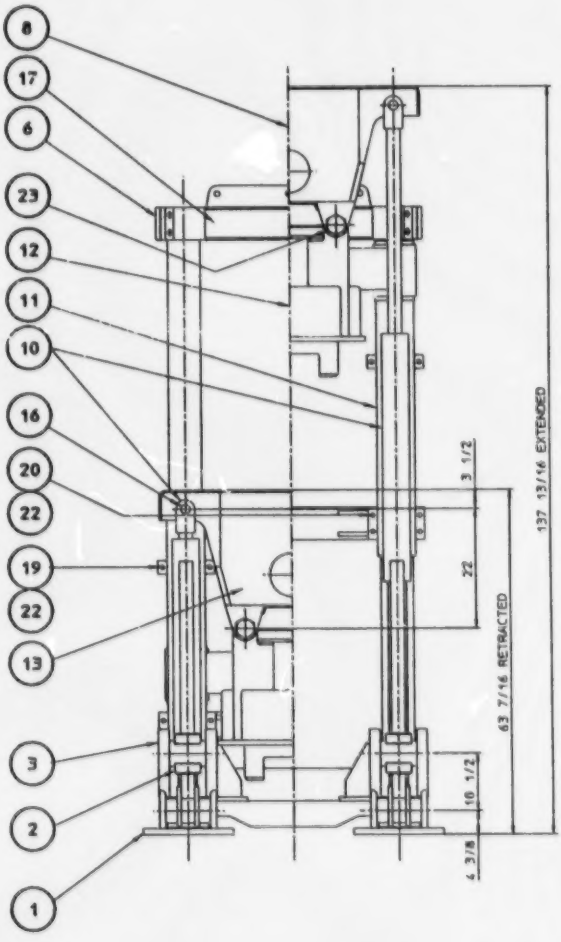
DRAWINGS

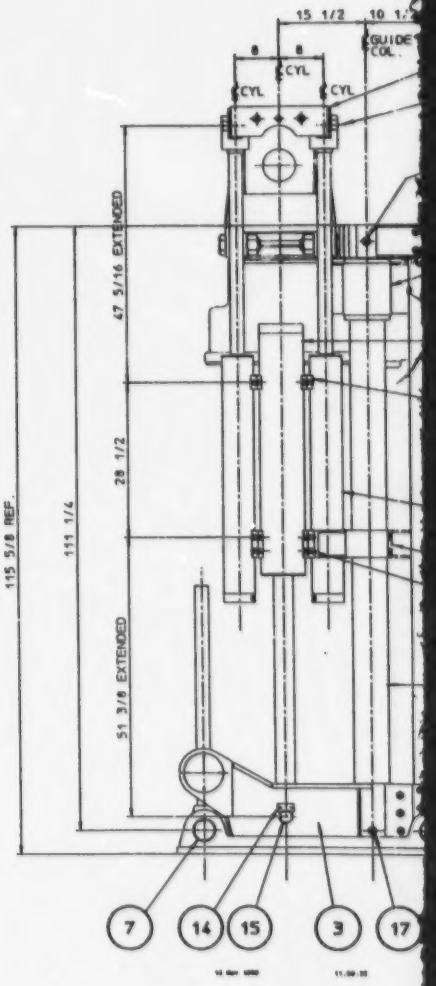
8.0 DRAWINGS

Drawing No.	Title
40-0100	General Assembly
40-0200	Foundation and Anchor Bolt Layout
40-0201	Station Layout - Limited Access and Space Limitation
40-0202	Station Layout - Typical Application For Optimum Set Up and Operation
40-1300	Main Frame Assembly - Isometric View
40-5133	Down Reamer Application - Drill Stabilizer, Hole Opener and G.A.
40-13000	Down Reaming Option - Main Frame Isometric Drawing
40-13200	Down Reaming Option - Foundation and Anchor Bolt Layout
40-13202	Down Reaming Option - Station Layout - Typical Application for Optimum Set-up and Operation

4288-40-0100







NO	REVISIONS	BY	DATE	CK'D
4				
3				
2				
1	REVISED EXTENDED/RETRACTED DIMENSIONS	KJH	16/11/89	

GENERAL NOTES

1. MACHINED SURFACES SHALL BE 125 UNLESS OTHERWISE SPECIFIED.
2. REMOVE ALL BURRS & SHARP EDGES.
3.

FINISH SYMBOLS

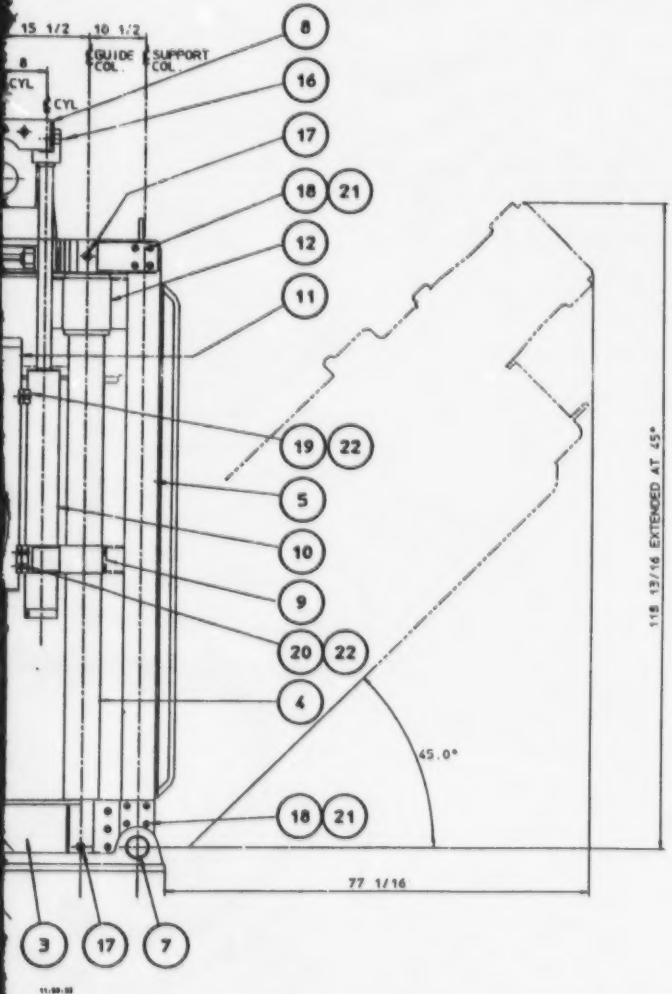
125	COMMON MACHINING
63	SMOOTH MACHINING
32	GRIND OR EQUAL
✓	DESCRIPTION

TOLERANCES

WHOLE OR FRAC	
TWO PLACE DEC	
THREE PLACE	
ANGLES	

ITEM	DESCRIPTION	PART/DWG.No.	QTY.
1	MOUNTING BASE ASSEMBLY	40-1100	2
2	TURNBUCKLE ASSEMBLY	40-1200	2
3	MAIN FRAME ASSEMBLY	40-1300	1
4	GUIDE COLUMN ASSEMBLY	40-1400	2
5	SUPPORT COLUMN ASSEMBLY	40-1500	2
6	HEAD FRAME ASSEMBLY	40-1600	1
7	PIN	40-1700	4
8	THRUST FRAME ASSEMBLY	40-2100	1
9	CYLINDER SUPPORT FRAME ASSEMBLY	40-2200	1
10	HYDRAULIC CYLINDER ASSEMBLY 5 ø	40-2300	4
11	HYDRAULIC CYLINDER ASSEMBLY 7 ø	40-2400	2
12	MAIN GEAR CASE ASSEMBLY	40-3000	1
13	SHIFT LINKAGE ASSEMBLY	40-3300	1
* 14	LOCKPLATE C/W 2 HEX. BOLTS 3/8-16UNC X 3/4	40-1306	2
* 15	EYE PIN 7ø CYLINDER	40-1305	2
* 16	CLEVIS PIN 5ø CYLINDER	40-2104	4
* 17	GUIDE COLUMN RETAINER PIN	40-1402	2
* 18	HEX. HEAD BOLT 5/8-11UNC X 8 GR.8		16
* 19	SOCKET HEAD BOLT 3/4-10UNC X 2 GR.8		8
* 20	SOCKET HEAD BOLT 3/4-10UNC X 3 1/2 GR.8		4
* 21	HEAVY HEX. 'NYLOCK' NUT 5/8-11UNC		16
* 22	HEAVY HEX. 'NYLOCK' NUT 3/4-10UNC		12
* 23	BOLT	40-2102	4
* 24	NUT	40-2103	4

* THESE ITEMS ARE CALLED ON THEIR RESPECTIVE ASSEMBLY DRAWINGS SHOWN IN BOM AND ARE ALSO CALLED HERE FOR REFERENCE.



NOTE: ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN INCHES UNLESS OTHERWISE NOTED.

THIS DRAWING & ALL DATA THEREIN IS THE PROPERTY OF J.S. REDPATH LTD., NORTH BAY, ONT., IS CONFIDENTIAL & MUST NOT BE COPIED. IT IS LOANED SUBJECT TO RETURN UPON DEMAND & IS NOT TO BE USED IN ANY WAY DETRIMENTAL TO OUR INTEREST.

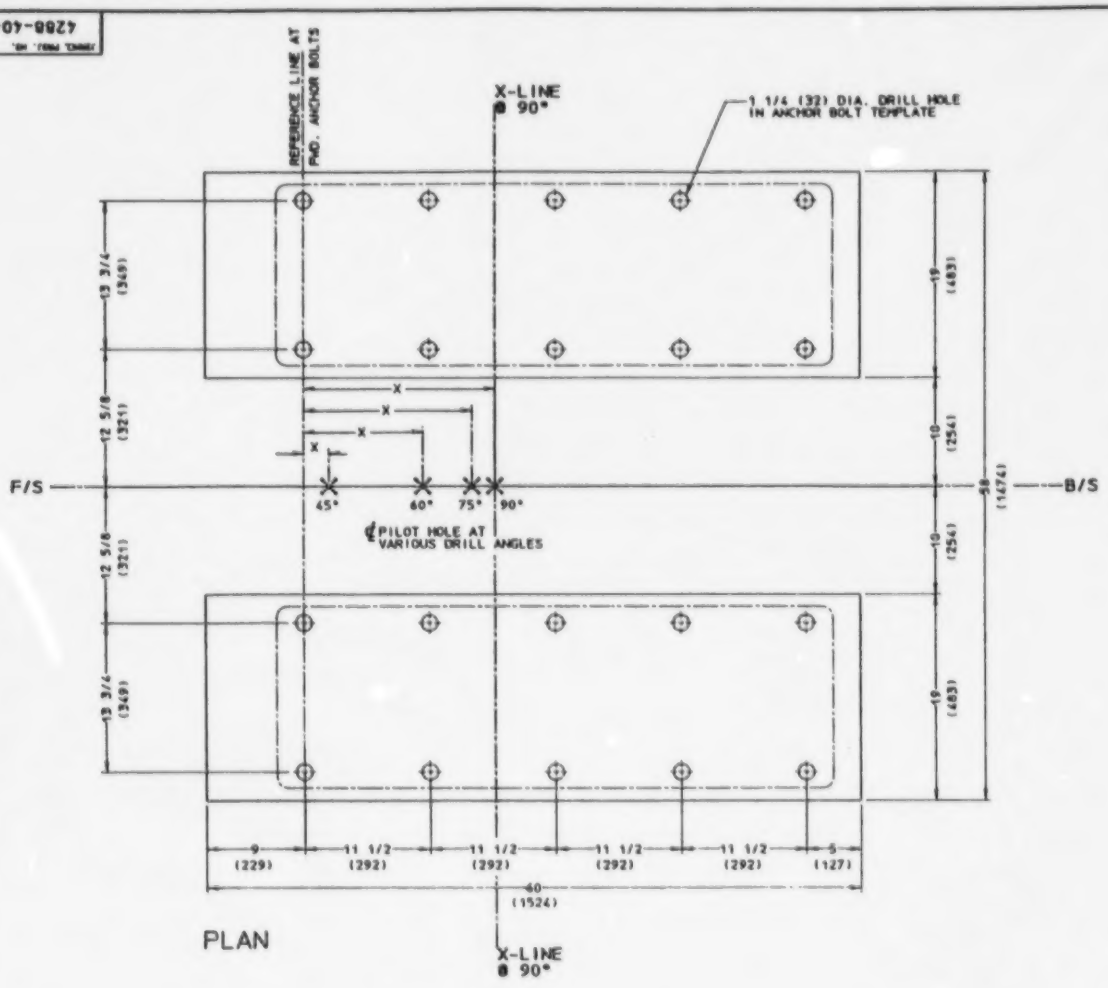
NEXT ASS'Y.	40-0000		
ITEM			
DRAWN BY	DBH	DATE	20/09/89
CHECKED		DATE	
APPROVED		DATE	
THIRD ANGLE PROJECTION			

REDPATH MANUFACTURING LIMITED

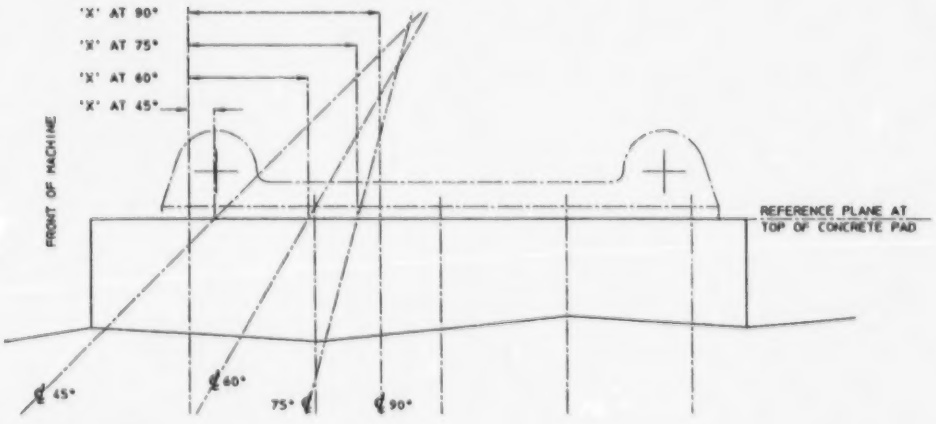
MACHINE	REDBORE 40
TITLE	GENERAL ASSEMBLY
DATE	SEP. '89
SCALE	1/16FULL
DWG NO.	40-0100
REV.	0

WHOLE OR FRACTIONAL..... ± 1/32	MATERIAL
TWO PLACE DECIMAL..... ± .010	HEAT TREATMENT
THREE PLACE DECIMAL .... ± .005	HARDEN CARBURIZE
ANGLES ..... ± 1/2°	DRAW HARDNESS
TOLERANCES UNLESS SPECIFIED	MATERIAL SPECIFICATIONS

4288-40-0200



PLAN



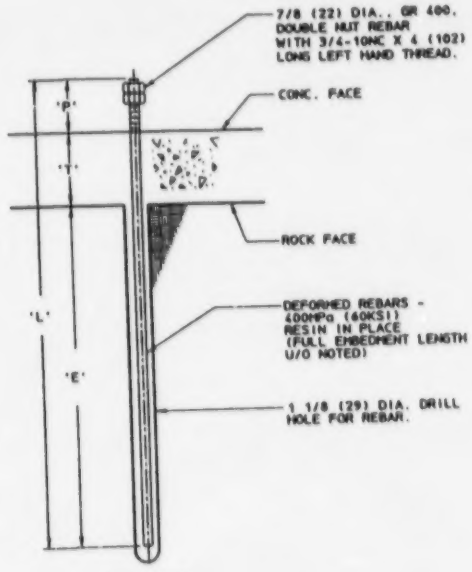
ELEVATION
SCALE: 1 1/2"=1'-0"

JSR

NO	REVISIONS	BY	DATE	CK'D
4				
3				
2				
1	REVISED RECESS DEPTH	MDF	11/88	

FINISH SYMBOLS		TOLERANCES UNLESS SPECIFIED
125	COMMON MACHINING	WHOLE OR FRACTIONAL..... ± 1/32
63	SMOOTH MACHINING	TWO PLACE DECIMAL..... ± .010
32	GRIND OR EQUAL	THREE PLACE DECIMAL .... ± .005
✓	DESCRIPTION	ANGLES ..... ± 1/2°

THIS DRAWING & ALL DAT
THEREIN IS THE PROPERTY
OF J.S. REDPATH LTD.,
NORTH BAY, ONT., IS
CONFIDENTIAL & MUST NO
BE COPIED. IT IS LOANE
SUBJECT TO RETURN UPON
DEMAND & IS NOT TO BE
USED IN ANY WAY DETRI-
MENTAL TO OUR INTEREST.


7/8 (22) DIA., GR 400, DOUBLE NUT REBAR WITH 3/4-10NC X 4 (102) LONG LEFT HAND THREAD.
CONC. PACE
'P'
'T'
ROCK FACE
DEFORMED REBARS - 400MPa (60KSI) RESIN IN PLACE (FULL EMBEDMENT LENGTH U/O NOTED)
'L'
'E'
1 1/8 (29) DIA. DRILL HOLE FOR REBAR.

STRAIGHT TYPE

RAISE BORE DRILL ANGLE	'E' EMBEDMENT	'T' CONC. THK.	'P' PROJ & THRD LGTH	'L' LENGTH
90° - 70°	32 (813)	10 (254)	6 (152)	48 (1219)
70° - 45°	52 (1321)	2 (51)	6 (152)	60 (1524)

DIMENSIONS ARE GIVEN IN INCHES AND MILLIMETERS.

STANDARD DETAILS - SD709-04/001

JSR ROCK ANCHORS - RESIN DOWELS STRAIGHT TYPE

DETAIL # 01

FOUNDATION TABLE

HOLE ANGLE FROM HORZ.	DISTANCE 'X' in	DISTANCE 'X' mm	HOLE ANGLE FROM HORZ.	DISTANCE 'X' in	DISTANCE 'X' mm
90°	17.500	445	67°	13.397	340
89°	17.419	442	66°	13.092	333
88°	17.331	440	65°	12.772	324
87°	17.235	438	64°	12.438	316
86°	17.130	435	63°	12.090	307
85°	17.018	432	62°	11.727	298
84°	16.897	429	61°	11.347	288
83°	16.767	426	60°	10.952	278
82°	16.629	422	59°	10.539	268
81°	16.483	419	58°	10.108	257
80°	16.327	415	57°	9.657	245
79°	16.163	411	56°	9.187	233
78°	15.989	406	55°	8.696	221
77°	15.806	401	54°	8.184	208
76°	15.613	396	53°	7.648	194
75°	15.410	391	52°	7.087	180
74°	15.197	386	51°	6.502	165
73°	14.974	380	50°	5.888	150
72°	14.740	374	49°	5.246	133
71°	14.495	368	48°	4.574	116
70°	14.239	362	47°	3.869	98
69°	13.970	355	46°	3.131	80
68°	13.690	348	45°	2.354	60

NOTES:

- THE ℄ OF THE PILOT HOLE STARTING POINT, AT 90° FROM HORIZONTAL, IS LOCATED ON THE BASE PLATES 17 1/2 (445) BACK FROM A REFERENCE LINE AT THE FRONT ANCHOR BOLT HOLES.
- THE ℄ OF THE PILOT HOLE MUST BE ALIGNED WITH THE SURVEY CROSS-LINE.
- AT ANGLES BELOW 90° THE ℄ OF THE PILOT HOLE STARTING POINT WILL MOVE FORWARD IN RELATION TO THE REFERENCE LINE. TO MAINTAIN ALIGNMENT WITH THE CROSS-LINE THE BASE PLATES MUST BE MOVED BACK ACCORDINGLY. THE AMOUNT OF SET BACK FOR HOLE ANGLES IS GIVEN IN THE ABOVE TABLE. THE VALUES TABLED ARE THE DISTANCE BETWEEN THE REFERENCE LINE AND THE CROSS-LINE.
- ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN INCHES WITH METRIC EQUIVALENT SHOWN IN PARENTHESIS (mm).

CONCRETE PAD NOTES:

- LEAVE 14 (356) DEEP RECESS BETWEEN CONCRETE PADS TO FACILITATE BLOOIE INSTALLATION IN NEAR VERTICAL POSITIONS.
- CONCRETE PADS TO BE:
  90° - 70°: MIN. 14 (356) PAD
  70° - 45°: MIN. 6 (152) PAD
  OR AS REQ'D TO MAKE PAD LEVEL.
- AREA TO BE BLOWN CLEAN PRIOR TO POURING PAD. CONCRETE TO BE APPROX. 3000 PSI (21 MPa)

REFERENCE DRAWINGS

STATION LAYOUT LIMITED ACCESS - 40-0201
STATION LAYOUT TYPICAL APPLICATION - 40-0202

DRAWING & ALL DATA IN IS THE PROPERTY OF REDPATH LTD., BAY, ONT., IS CONFIDENTIAL & MUST NOT BE COPIED. IT IS LOANED SUBJECT TO RETURN UPON DEMAND & IS NOT TO BE USED IN ANY WAY DETRIMENTAL TO OUR INTEREST.

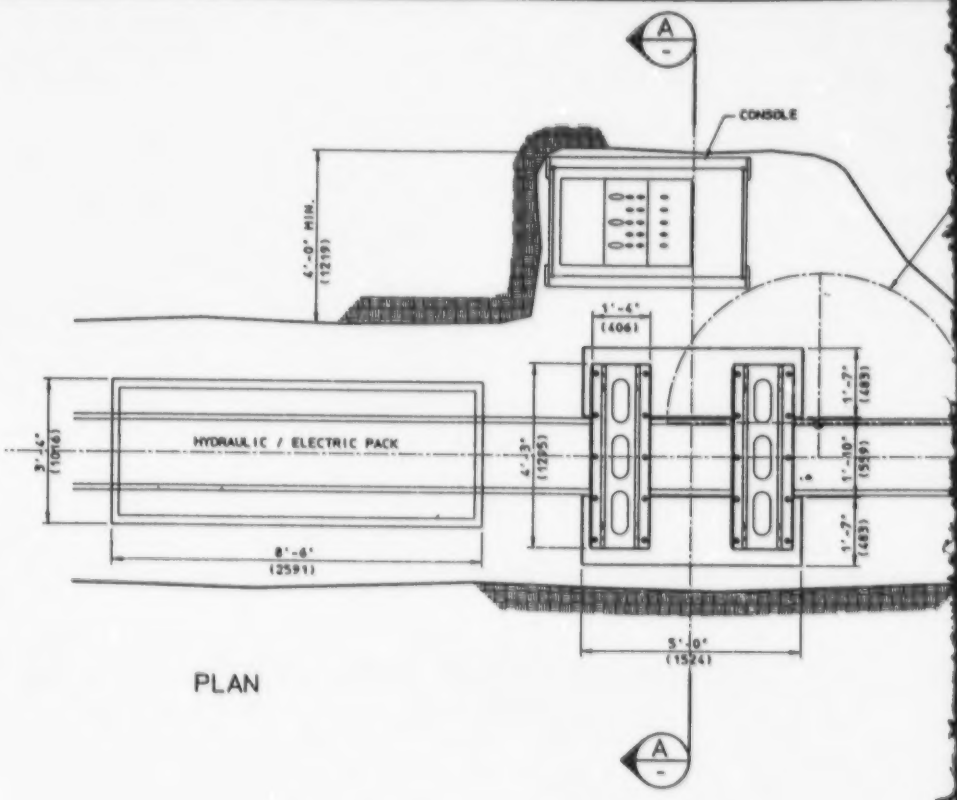
NEXT ASS'Y .
ITEM .
THIRD ANGLE PROJECTION

DRAWN BY DBM DATE 13/06/88
CHECKED MH JPB DATE 13/06/88
APPROVED MK DATE 13/06/88

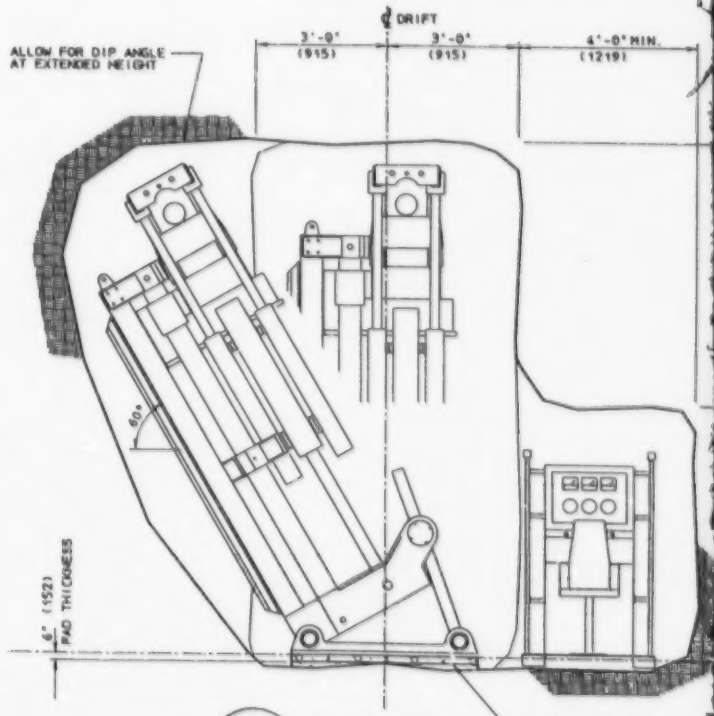
MACHINE REDBORE 40
TITLE FOUNDATION AND ANCHOR BOLT LAYOUT .

REDPATH MANUFACTURING
A Division of the JE REDPATH GROUP OF COMPANIES

DATE JUNE '88 | SCALE AS NOTED | DWG NO. 40-0200 | REV 1



PLAN



AA SECTION

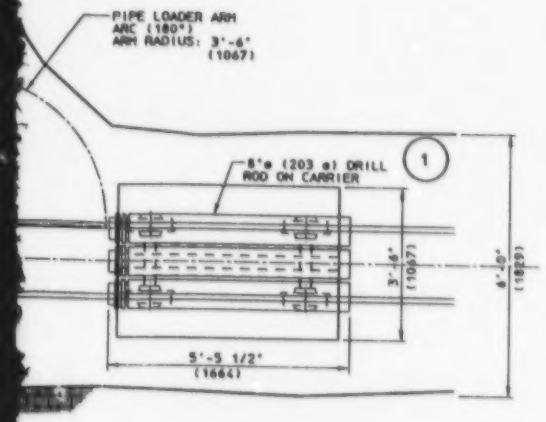
90° - 70°: MIN. 14"
70° - 45°: MIN. 6"
OR AS REQ'D
MAKE PAD LE

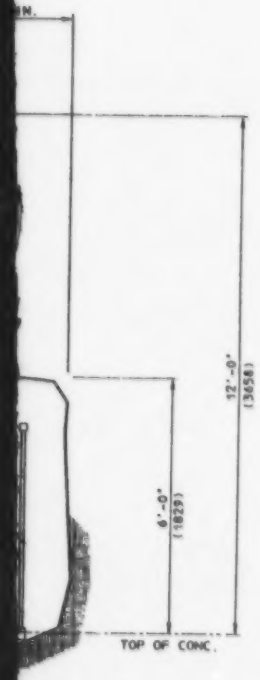
NO	REVISIONS	BY	DATE	CK'D
1	REVISED RECESS DEPTH	MDF	11/88	

FINISH SYMBOLS		
125	COMMON MACHINING	WHOLE OR FRACTIONAL..... ± 1/32
63	SMOOTH MACHINING	TWO PLACE DECIMAL..... ± .010
32	GRIND OR EQUAL	THREE PLACE DECIMAL .... ± .005
✓	DESCRIPTION	ANGLES ..... ± 1/2°

TOLERANCES UNLESS SPECIFIED

THIS DRAWING & ALL
THEREIN IS THE PRO
OF J.S. REDPATH L
NORTH BAY ONT.
CONFIDENTIAL & MUS
BE COPIED. IT IS L
SUBJECT TO RETURN
DEMAND & IS NOT TO
USED IN ANY WAY DE
MENTAL TO OUR INTE





14" (356) PAD
6" (152) PAD
AS REQ'D TO
E PAD LEVEL.

1

POWER REQUIREMENTS

550V TO 600V 3PH. - 60 CYCLE ELECTRIC POWER 150 KVA. TOTAL CONNECTION POWER OR 250 KVA. FROM DIESEL GENERATOR.
TYPICALLY 200A 3PH BREAKER.

AIR REQUIREMENTS

800 CFM.(.378 m3/s) AT 90 - 100 PSI (620 kPa - 689 kPa) PILOT HOLE DRILLING.
(DRY CUTTING REMOVAL)

WATER REQUIREMENTS

DRY CUTTING REMOVAL:

10 USGPM (38 l/min.) AT 60 - 100 PSI (414 kPa - 689 kPa) FOR DUST SUPPRESSION AND COOLING.

WET CUTTING REMOVAL:

180 USGPM (681 l/min.) AT 90 PSI (620 kPa) PLUS 550V - 3 PH - 60 CYCLE ELECTRIC POWER TO OPERATE A 25 HP. (19 KW) WATER PUMP. SUMP APPROX. 5000 USGAL. (18927 l) CAP. MAX. 75 FT. (23 m) FROM MACHINE.

ROD STORAGE (1)

SUFFICIENT AREA MUST BE AVAILABLE FOR DRILL ROD STORAGE . TOTAL AREA REQUIRED IS DETERMINED BY LENGTH OF RAISE.
8"ø X 5' (203 mmø X 1524 mm) DRILL RODS ARE NORMALLY STORED ON 4" X 6" (102 mm X 152 mm) TIMBERS STACKED TWO ROWS HIGH (3 ROWS MAX.)

DRILL RODS

8"ø (203 mmø), 60" (1524 mm) SHOULDER TO SHOULDER 450 LBS (204 kg) EACH 68" - 70" (1727 mm - 1778 mm) OVERALL LENGTH.

NOTE:

ALL DIMENSIONS GIVEN ARE MINIMUM ALLOWABLE CLEARANCES FOR OPTIMUM SET UP AND OPERATION.
SHOULD YOU HAVE A REQUIREMENT FOR LIMITED ACCESS OR AN EXCAVATION RESTRICTION, PLEASE CONTACT US FOR A SPECIAL EXCAVATION LAYOUT.
DIMENSIONS GIVEN IN FEET AND MILLIMETERS.

REFERENCE DRAWING:

FOUNDATION AND ANCHOR BOLT LAYOUT - 40-0200

...G & ALL DATA ...THE PROPERTY ...PATH LTD. ...ONT., IS ...L & MUST NOT ...IT IS LOANED ...RETURN UPON ...NOT TO BE ...WAY DETRI- ...UR INTEREST.

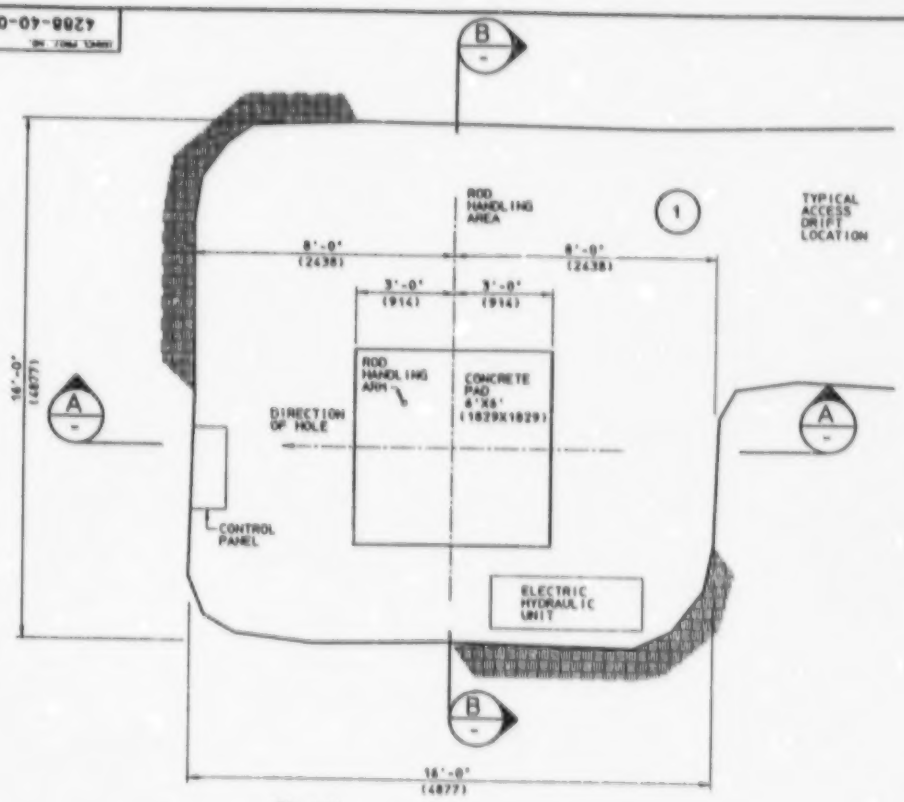
NEXT ASS'Y		DRAWN BY	DBH
		DATE	11/04/88
FROM		CHECKED	MH JPB
		DATE	13/06/88
THIRD ANGLE PROJECTION		APPROVED	MK
		DATE	13/06/88

MACHINE: REDBORE 40

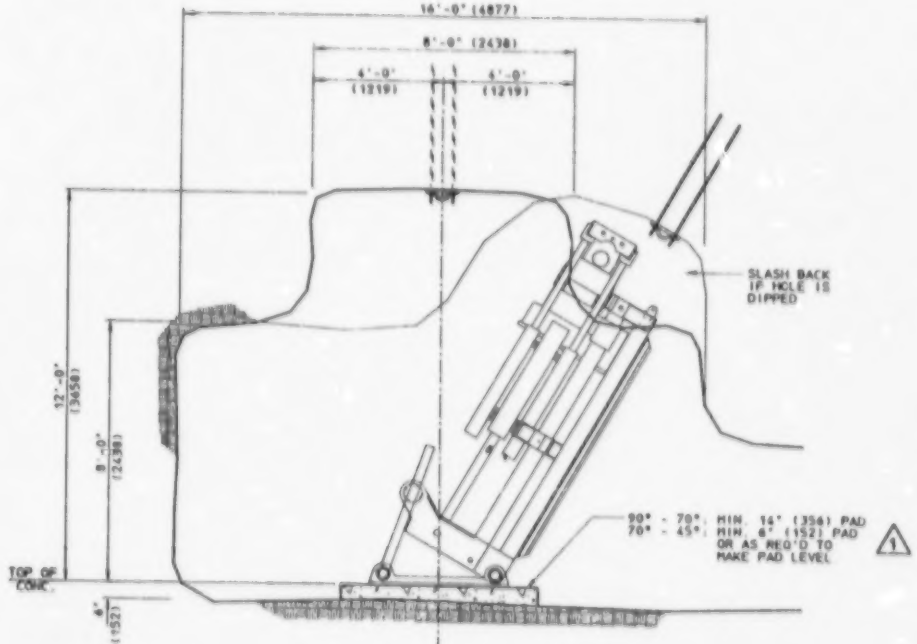
TITLE: STATION LAYOUT LIMITED ACCESS AND SPACE APPLICATION

REDPATH MANUFACTURING
A Division of the JS REDPATH GROUP OF COMPANIES

DATE	SCALE	DWG NO.	REV.
APR. '88	1/2"=1'-0"	40-0201	1



PLAN



AA SECTION

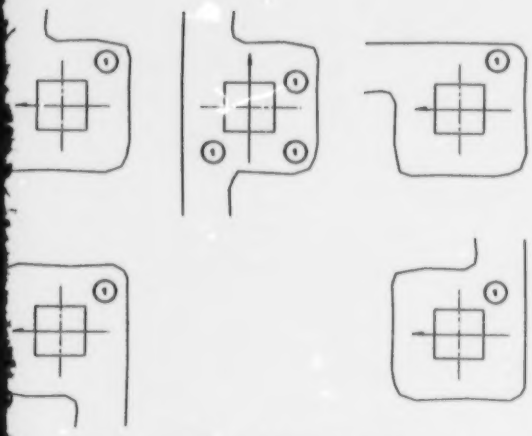
BB

NO	REVISIONS	BY	DATE	CK'D
4				
3				
2				
1	REVISED RECESS DEPTH	MDF	11/88	

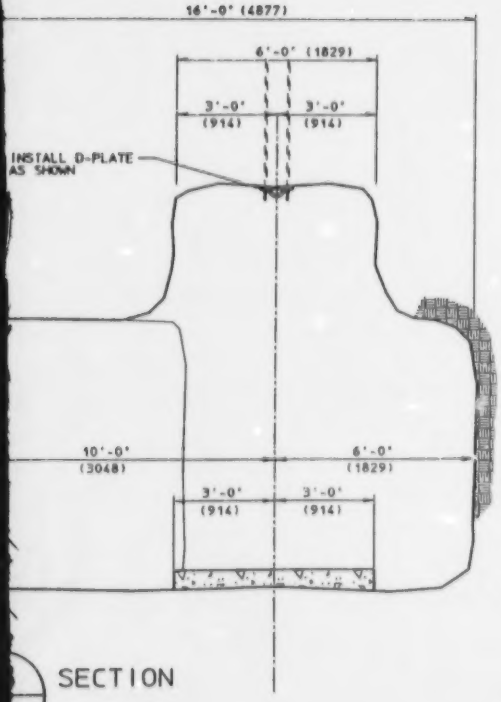
FINISH SYMBOLS		
125	COMMON MACHINING	WHOLE OR FRACTIONAL ..... ± 1/32
63	SMOOTH MACHINING	TWO PLACE DECIMAL ..... ± .010
32	GRIND OR EQUAL	THREE PLACE DECIMAL ..... ± .005
✓	DESCRIPTION	ANGLES ..... ± 1/2°

TOLERANCES UNLESS SPECIFIED

THIS DRAWING & ALL DA
THEREIN IS THE PROPE
OF J.S. REDPATH LTD
NORTH BAY, ONT.
CONFIDENTIAL & MUST
BE COPIED. IT IS LOA
SUBJECT TO RETURN UP
DEMAND & IS NOT TO B
USED IN ANY WAY DETR
MENTAL TO OUR INTERE



PLAN VIEWS OF ALTERNATE ACCESS
DRIFT LOCATIONS



SECTION

POWER REQUIREMENTS

550V TO 600V 3PH. - 60 CYCLE ELECTRIC
POWER 150 KVA. TOTAL CONNECTION
POWER OR 250 KVA. FROM DIESEL
GENERATOR.
TYPICALLY 200A 3PH BREAKER.

AIR REQUIREMENTS

800 CFM.(.378 m3/s) AT 90 - 100 PSI
(620 kPa - 689 kPa) PILOT HOLE DRILLING.
(DRY CUTTING REMOVAL)

WATER REQUIREMENTS

DRY CUTTING REMOVAL:

10 USGPM (38 l/min.) AT 60 - 100 PSI
(414 kPa - 689 kPa) FOR DUST SUPPRESSION
AND COOLING.

WET CUTTING REMOVAL:

180 USGPM (681 l/min.) AT 90 PSI (620 kPa) PLUS
550V - 3 PH - 60 CYCLE ELECTRIC POWER TO OPERATE
A 25 HP. (19 KW) WATER PUMP. SUMP APPROX. 5000 USGAL.
(18927 l) CAP. MAX. 75 FT. (23 m) FROM MACHINE.

ROD STORAGE (1)

SUFFICIENT AREA MUST BE AVAILABLE FOR
DRILL ROD STORAGE . TOTAL AREA REQUIRED
IS DETERMINED BY LENGTH OF RAISE.
8"ø X 5' (203 mmø X 1524 mm) DRILL RODS
ARE NORMALLY STORED ON 4" X 6" (102 mm X 152 mm)
TIMBERS STACKED TWO ROWS HIGH (3 ROWS MAX.)

DRILL RODS

8"ø (203 mmø), 60" (1524 mm) SHOULDER TO SHOULDER
450 LBS (204 kg) EACH 68" - 70" (1727 mm - 1778 mm)
OVERALL LENGTH.

NOTE:

ALL DIMENSIONS GIVEN ARE STANDARD
ALLOWABLE CLEARANCES FOR OPTIMUM
SET UP AND OPERATION.
SHOULD YOU HAVE A REQUIREMENT FOR
LIMITED ACCESS OR AN EXCAVATION
RESTRICTION, PLEASE CONTACT US FOR A
SPECIAL EXCAVATION LAYOUT.
DIMENSIONS GIVEN IN FEET AND MILLIMETERS.

REFERENCE DRAWING

FOUNDATION AND ANCHOR BOLT LAYOUT - 40-0200

...L DATA ...OPERTY ...LTO ... IS ... UST NOT ... LOANED ...N UPON ...TO BE ...DETRI- ...TEREST.

NEXT ASS'Y: .
ITEM: .
THIRD ANGLE PROJECTION

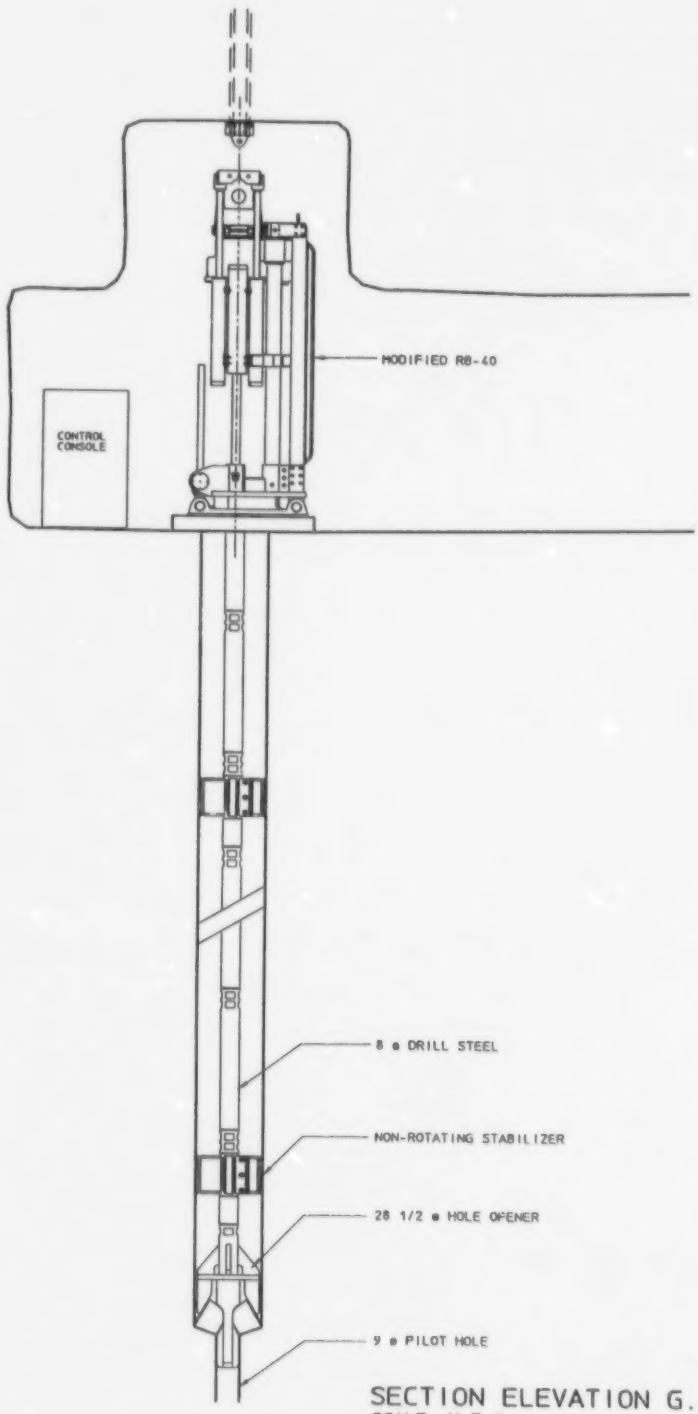
DRAWN BY: DBH
DATE: 11/04/88
CHECKED: HH JPB
DATE: 13/06/88
APPROVED: MK
DATE: 13/06/88

MACHINE: REDBORE 40

TITLE:
STATION LAYOUT
TYPICAL APPLICATION
FOR OPTIMUM SETUP AND OPERATION

REDPATH MANUFACTURING
A Division of the JB REDPATH GROUP OF COMPANIES

DATE	SCALE	DWG NO.	REV.
APR. '88	3/8"=1'-0"	40-0202	1

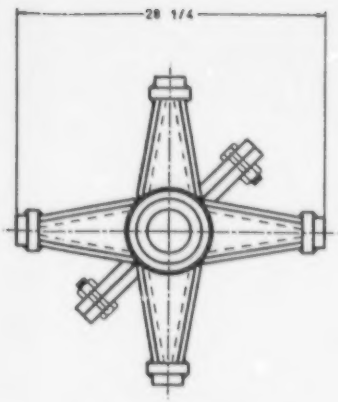


SECTION ELEVATION G.A.
SCALE: N.T.S.

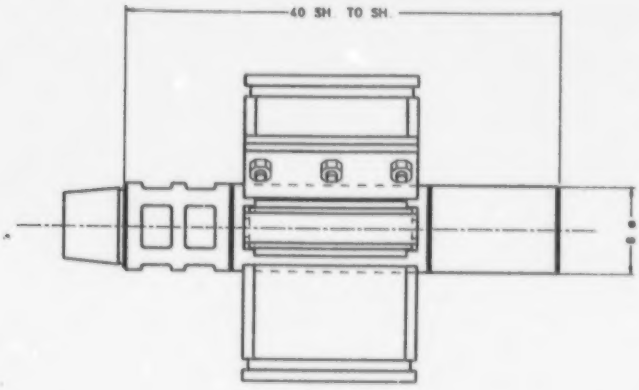
NO	REVISIONS	BY	DATE	CK'D
4				
3				
2				
1				

FINISH SYMBOLS		TOLERANCES UNLESS SPECIFIED	
125	COMMON MACHINING	WHOLE OR FRACTIONAL..... ± 1/32	
63	SMOOTH MACHINING	TWO PLACE DECIMAL..... ± .010	
32	GRIND OR EQUAL	THREE PLACE DECIMAL .... ± .005	
✓	DESCRIPTION	ANGLES ..... ± 1/2°	

THIS DRAWING & ALL DATA THEREIN IS THE PROPERTY OF J.S. REDPATH LTD., NORTH BAY ONT. IS CONFIDENTIAL & MUST NOT BE COPIED. IT IS LOANED SUBJECT TO RETURN UPON DEMAND & IS NOT TO BE USED IN ANY WAY DETRIMENTAL TO OUR INTEREST.

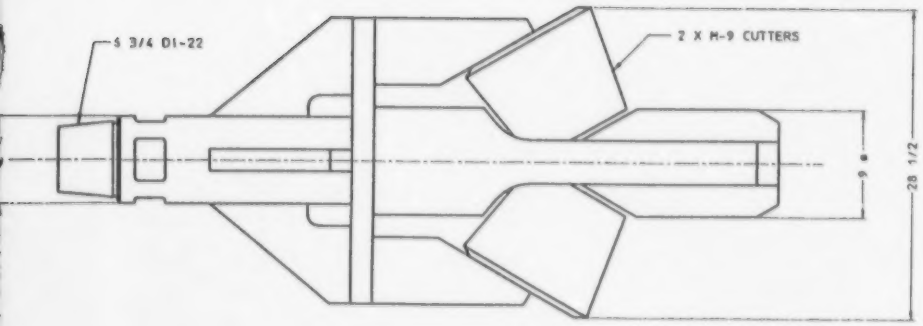


END VIEW

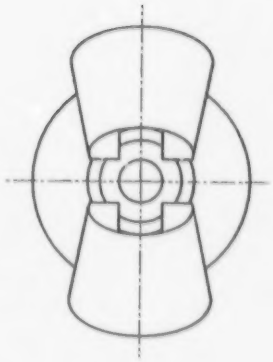


SIDE VIEW

NON-ROTATING STABILIZER
40-5130
SCALE: 1/8 FULL



SIDE VIEW



END VIEW

HOLE OPENER (28 1/2 ø)
40-5134
SCALE: 1/8 FULL

NOTE: 1. ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN INCHES UNLESS OTHERWISE NOTED.

RAWING & ALL DATA
N IS THE PROPERTY
REDPATH LTD.,
BAY, ONT., IS
ENTIAL & MUST NOT
IED. IT IS LOANED
T TO RETURN UPON
& IS NOT TO BE
N ANY WAY DETRI-
TO OUR INTEREST.

NEXT ASS'Y
.

ITEM
.

THIRD ANGLE PROJECTION

DRAWN BY DBH
DATE 20/03/90
CHECKED .
DATE .
APPROVED .
DATE .

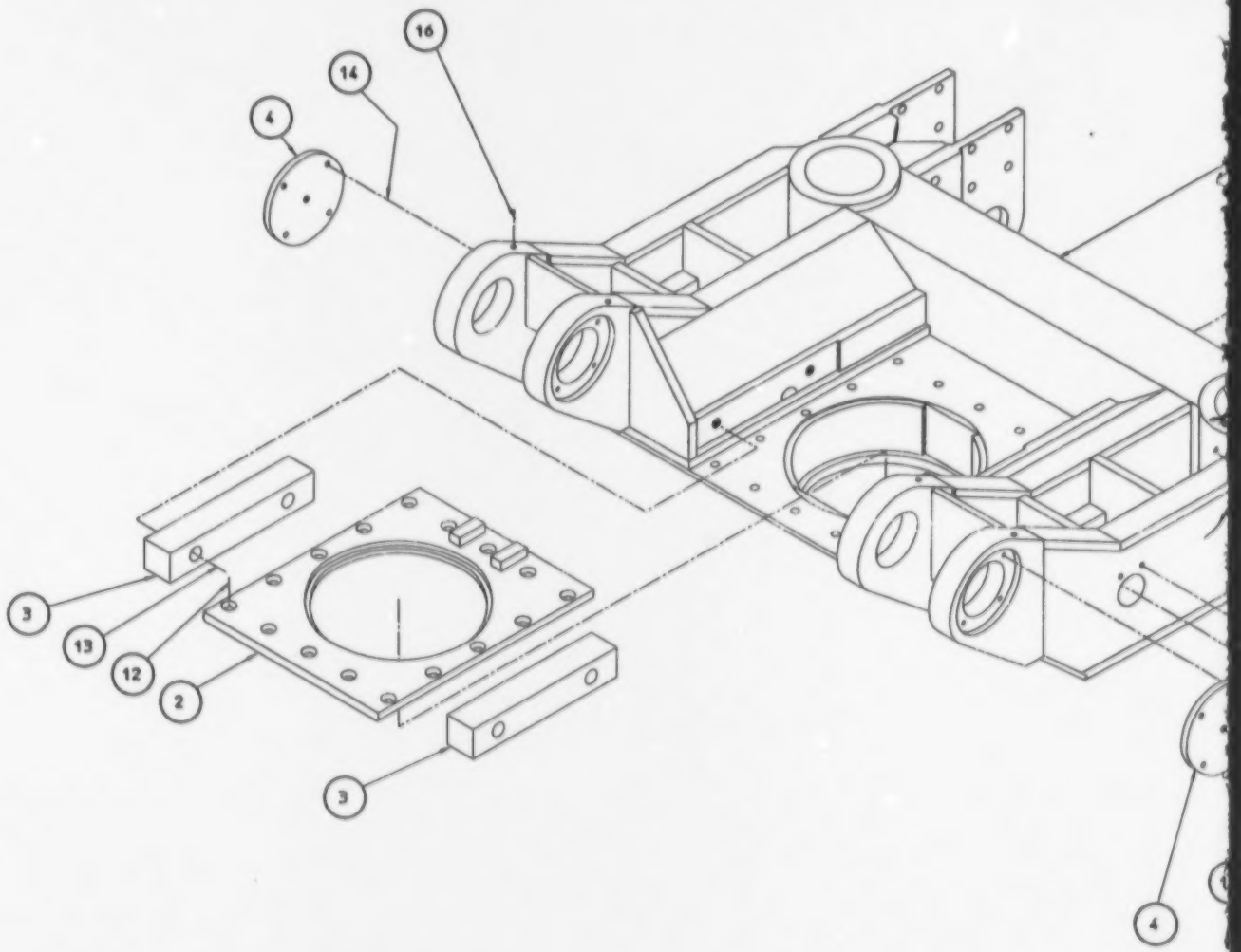
MACHINE
REDBORE 40

TITLE
DOWN REAMING APPLICATION
DRILL STABILIZER, HOLE OPENER
AND G.A.

REDPATH
RAISEBORING LIMITED

DATE	SCALE	DWG NO.	REV.
MAR. '90	NOTED	40-5133	0

6268-40-1300



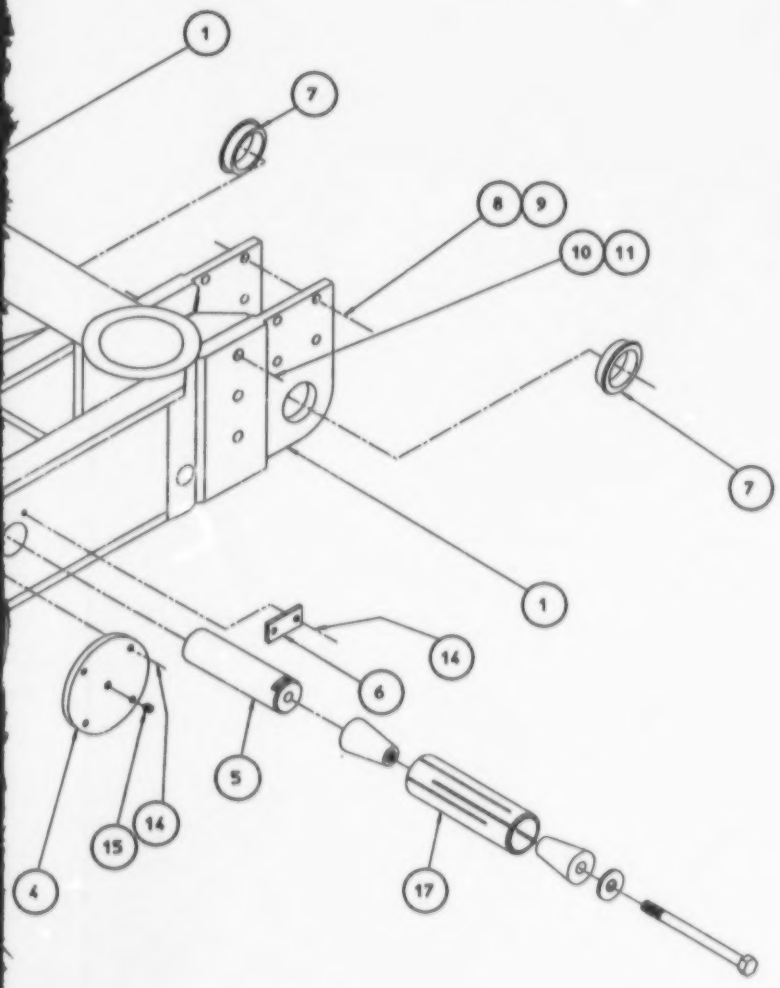
NO	REVISIONS	BY	DATE	CK'D
4				
3				
2				
1	ADDED OPTIONAL CYLINDER EXPANSION PIN	KJH	08/90	

FINISH SYMBOLS		TOLERANCES UNLESS SPECIFIED
125	COMMON MACHINING	WHOLE OR FRACTIONAL..... ± 1/32
63	SMOOTH MACHINING	TWO PLACE DECIMAL..... ± .010
32	GRIND OR EQUAL	THREE PLACE DECIMAL .... ± .005
✓	DESCRIPTION	ANGLES ..... ± 1/2°

THIS DRAWING & ALL DA
THEREIN IS THE PROPER
OF J.S. REDPATH LTD.
NORTH BAY, ONT., IS
CONFIDENTIAL & MUST
BE COPIED. IT IS LOA
SUBJECT TO RETURN UP
DEMAND & IS NOT TO BE
USED IN ANY WAY DETRI
MENTAL TO OUR INTERES

ITEM	DESCRIPTION	PART DWG. NO.	QTY.
1	MAIN FRAME WELDMENT	40-1301	1
2	WORK TABLE COVER PLATE	40-1302	1
3	WORK TABLE WEAR BAR	40-1303	2
4	RETAINER PLATE	40-1304	4
5	THRUST CYLINDER PIN (STANDARD)	40-1305	2
6	CYLINDER PIN LOCK PLATE	40-1306	2
7	PIVOT PIN BUSHING	40-1307	4
8	HEX. HEAD BOLT 3/8-11UNC X 8 LG.		8
9	'NYLOCK' NUT 3/8-11UNC		8
10	HEX. HEAD BOLT 3/4-10UNC X 9 LG.		4
11	'NYLOCK' NUT 3/4-10UNC		4
12	C/S SLOTTED HEAD MACHINE SCREW 5/8-11UNC X 1 LG.		16
13	SOCKET HEAD CAP SCREW 3/4-10UNC X 2 LG.		4
14	HEX HEAD MACHINE SCREW 3/8-16UNC X 1 LG. GR. 5		20
15	SET SCREW 1/2-13UNC X 1/2 LG.		2
16	STRAIGHT GREASE FITTING 1/8 NPT		4
17	THRUST CYLINDER EXPANSION PIN (OPTIONAL)	40-1320	2

NOTE: ALL BOLTS, NUTS AND SCREWS TO BE SAE GRADE 8 UNLESS OTHERWISE NOTED.



WINGS & ALL DATA
ARE THE PROPERTY
REDPATH LTD.,
ONT. IS
RIAL & MUST NOT
D. IT IS LOANED
TO RETURN UPON
IS NOT TO BE
ANY WAY DETRI-
OUR INTEREST.

NEXT ASS'Y 40-1000

ITEM

DRAWN BY K.M
DATE 04/07/88
CHECKED
DATE
APPROVED
DATE

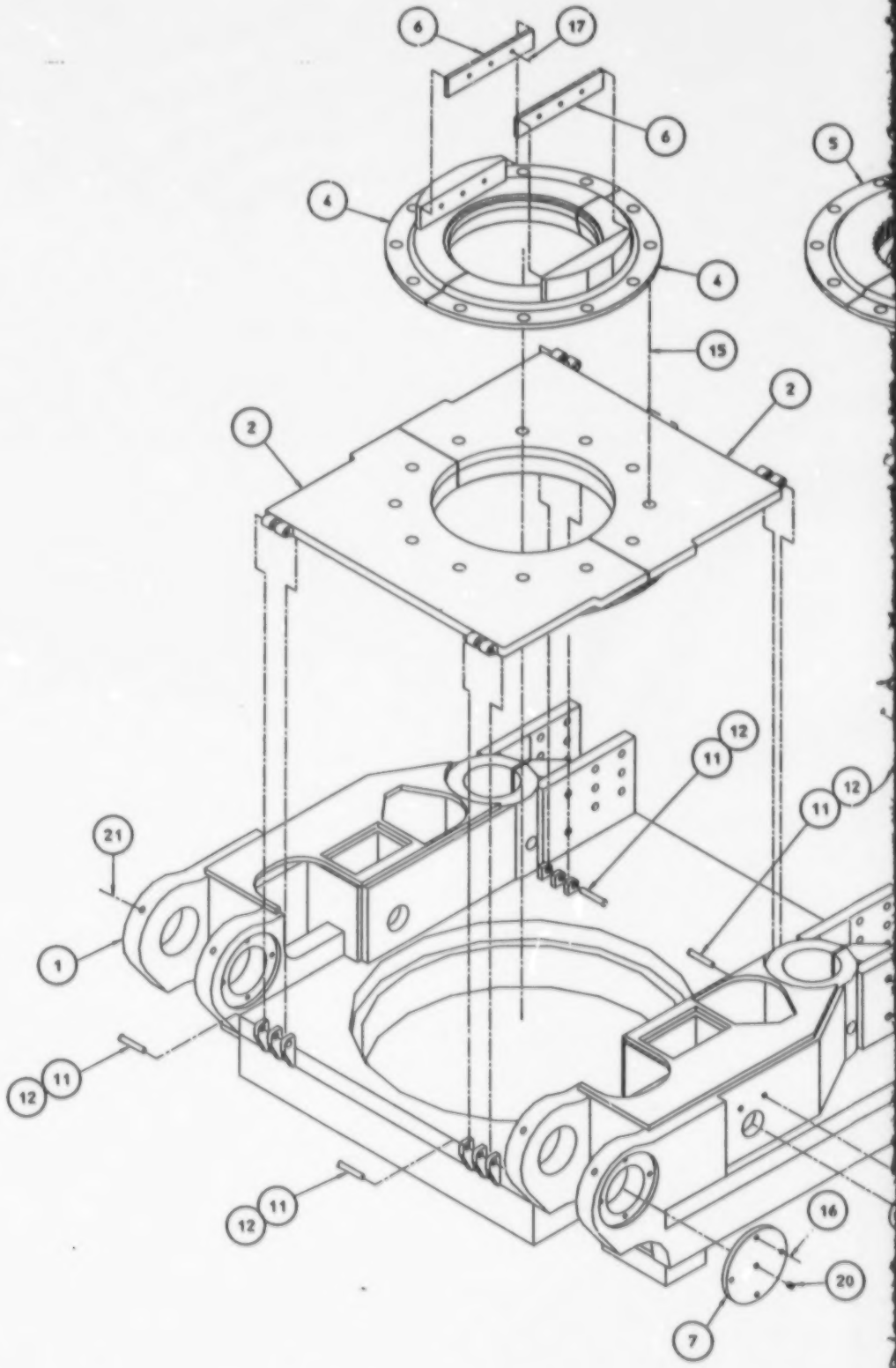
MACHINE REDBORE 40

TITLE MAIN FRAME ASSEMBLY
ISOMETRIC VIEW

REDPATH MANUFACTURING
A Division of the JB REDPATH GROUP OF COMPANIES

DATE APR. '88 | SCALE N.T.S. | DWG NO. 40-1300 | REV. 1

6500-40-13000

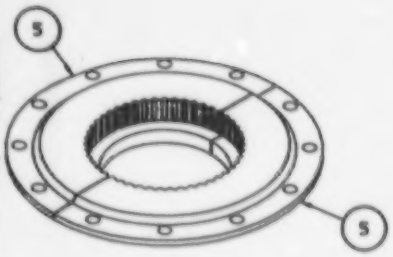


NO	REVISIONS	BY	DATE	CK'D
4				
3				
2				
1				

FINISH SYMBOLS		
125	COMMON MACHINING	WHOLE OR FRACTIONAL..... ± 1/32
63	SMOOTH MACHINING	TWO PLACE DECIMAL..... ± .010
32	GRIND OR EQUAL	THREE PLACE DECIMAL .... ± .005
✓	DESCRIPTION	ANGLES ..... ± 1/2°

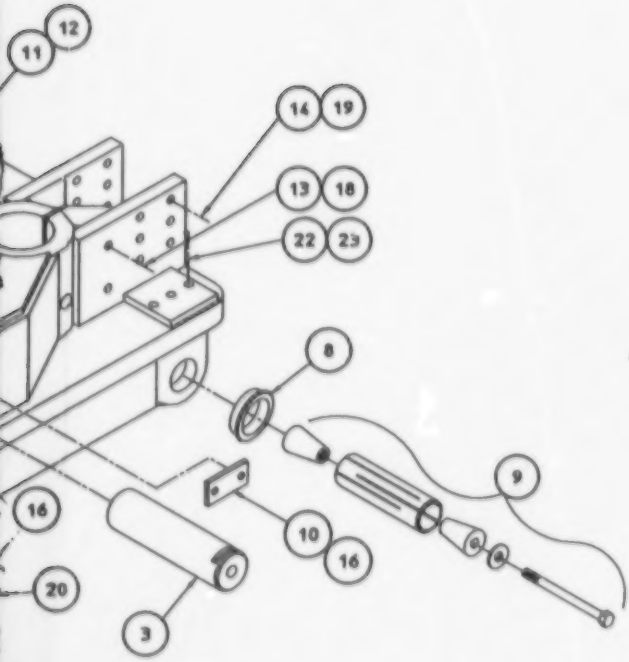
TOLERANCES UNLESS SPECIFIED

THIS DRAWING & ALL DA
THEREIN IS THE PROPER
OF J.S. REDPATH LTD.,
NORTH BAY, ONT., IS
CONFIDENTIAL & MUST
BE COPIED. IT IS LOAN
SUBJECT TO RETURN UP
DEMAND & IS NOT TO BE
USED IN ANY WAY DETRI
MENTAL TO OUR INTERES



ITEM	DESCRIPTION	PART/DWG.No.	QTY.
1	MAIN FRAME WELDMENT	40-13001/40-13001	1
2	HINGED WORK TABLE	40-13002/40-13002	2
3	CYLINDER PIN	40-13003/40-13003	2
4	WORK TABLE INSERT (STANDARD)	40-13004/40-13004	1
5	SPLINED WORK TABLE INSERT (OPTIONAL)	40-13005/40-13005	1
6	WRENCH BAR WEAR PLATE	40-13006/40-13006	2
7	RETAINER PLATE	40-1304/40-1302	4
8	PIVOT BUSHING	40-1307/40-1302	4
9	BASE PLATE EXPANSION PIN ASSEMBLY	40-13700/40-13700	4
10	CYLINDER PIN LOCK PLATE	40-1306/40-1302	2
11	CLEVIS PIN 1 ø X 4 1/8 LG.	40-13007/40-13007	4
12	HITCH PIN (SPAE-HAUR CP-73H OR EQUAL)		4
13	HEX. HEAD BOLT 3/4-10UNC X 9 LG.		4
14	HEX. HEAD BOLT 3/8-11UNC X 9 LONG		12
15	HEX. HEAD MACHINE SCREW 1-8UNC X 1 1/2 LG.		12
16	HEX. HEAD MACH.SCREW 3/8-16UNC X 1LG. GR.5		20
17	C/SUNK MACH.SCREW 3/8-16UNC X 3/4 LG.		6
18	NYLOCK HEX. NUT 3/4-10UNC		4
19	NYLOCK HEX. NUT 3/8-11UNC		12
20	SET SCREW 1/2-13UNC X 1/2 LG.		2
21	STRAIGHT GREASE FITTING 1/8 NPT		4
22	HEX. HEAD CAP SCREW 3/8-11 UNC X 1 1/2 LG.		6
23	HELICAL SPRING LOCK WASHER 3/8ø		6

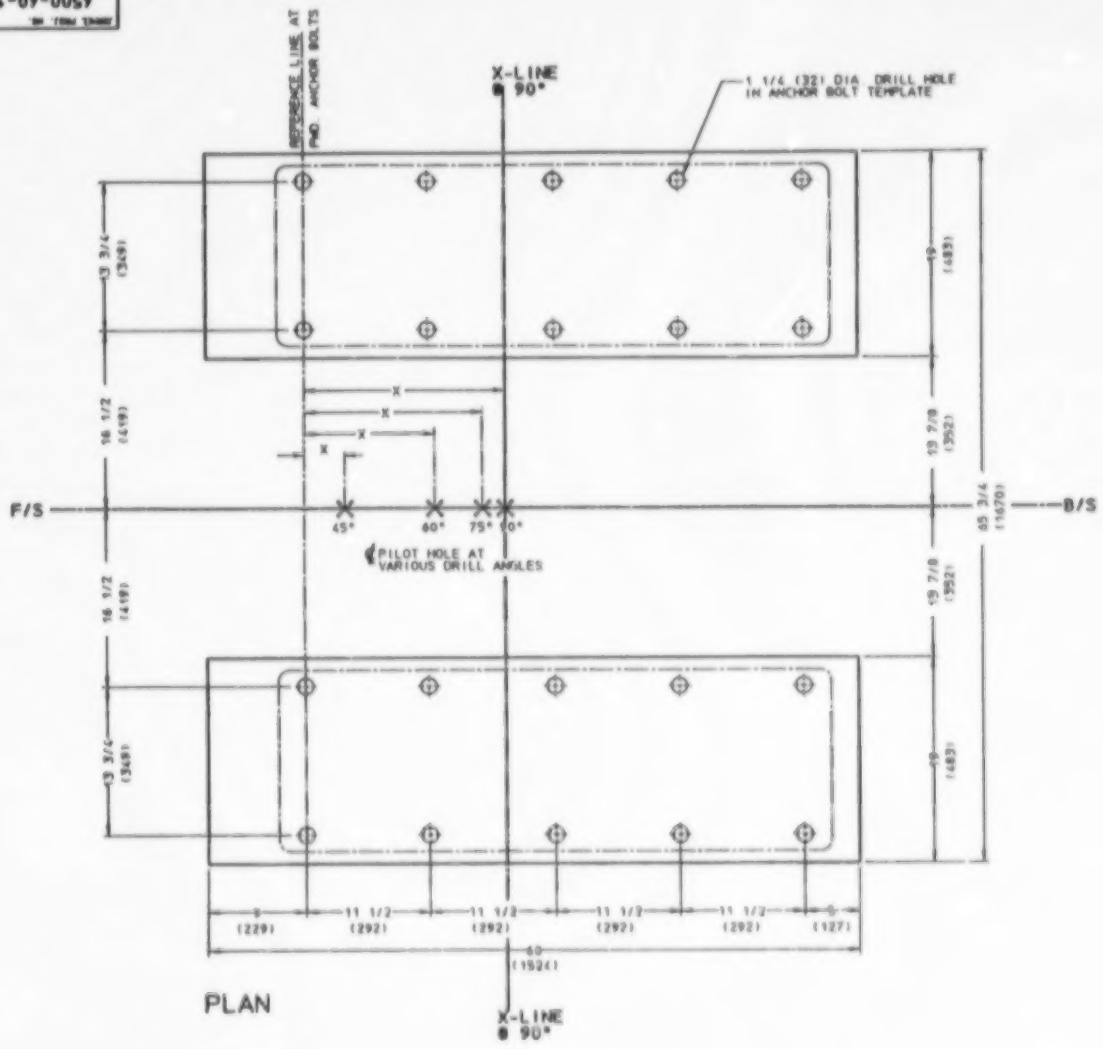
NOTE: 1. ALL BOLTS, NUTS AND SCREWS TO BE SAE GRADE 8 OR BETTER UNLESS OTHERWISE NOTED.



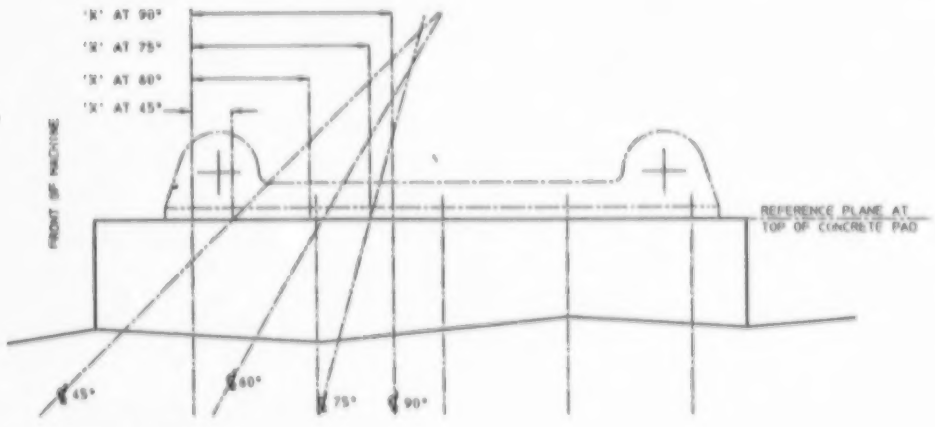
...WING & ALL DATA ...IS THE PROPERTY ...EDPATH LTD. ... OUT ... IS ...IAL & MUST NOT ... IT IS LOANED ...O RETURN UPON ... IS NOT TO BE ...ANY WAY DETRI- ...D OUR INTEREST.

PART NO'S 40-13100	DRAWN BY DBM	DRAWING REDBORE 40	REDPATH RAISEBORING LIMITED
ITEM .	DATE 11/04/90	TITLE DOWN REAMING APPLICATION MAIN FRAME GEN. ASSEMBLY ISOMETRIC DRAWING	
THIRD ANGLE PROJECTION	CHECKED .		
	DATE .		
	APPROVED .		
	DATE .		
	DATE APR. '90	SCALE N.T.S.	DWG NO. 40-13000

6500-40-13200



PLAN

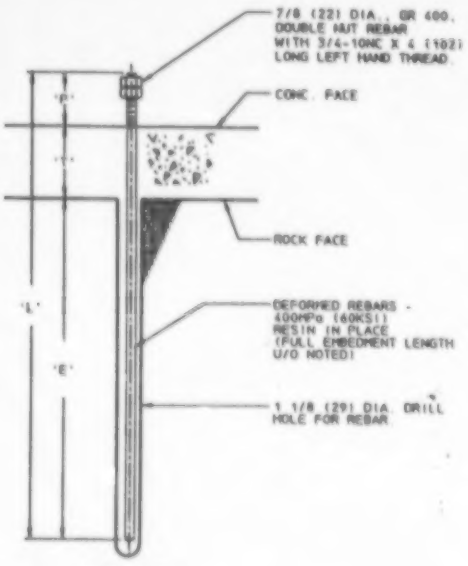


ELEVATION
SCALE: 1 1/2"=1'-0"

NO	REVISIONS	BY	DATE	CK'D
4				
3				
2				
1				

FINISH SYMBOLS		TOLERANCES UNLESS SPECIFIED	
125	COMMON MACHINING	WHOLE OR FRACTIONAL..... ± 1/32	
63	SMOOTH MACHINING	TWO PLACE DECIMAL..... ± .010	
32	GRIND OR EQUAL	THREE PLACE DECIMAL .... ± .005	
✓	DESCRIPTION	ANGLES ..... ± 1/2°	

THIS DRAWING & ALL DA
THEREIN IS THE PROPER
OF J. S. REDPATH LTD.
NORTH BAY, ONT., (S.
CONFIDENTIAL & MUST
BE COPIED. IT IS LOA
SUBJECT TO RETURN UP
DEMAND & IS NOT TO BE
USED IN ANY WAY DETRI
MENTAL TO OUR INTERES


7/8 (22) DIA., GR 400, DOUBLE NUT REBAR WITH 3/4-10NC X 4 (102) LONG LEFT HAND THREAD.
CONC. FACE
'P'
'T'
ROCK FACE
'L'
'E'
DEFORMED REBARS - 400MPa (60KSI) RESIN IN PLACE (FULL EMBEDMENT LENGTH U/O NOTED)
1 1/8 (29) DIA. DRILL HOLE FOR REBAR

STRAIGHT TYPE

RAISE BORE DRILL ANGLE	'E' EMBEDMENT	'T' CONC THK	'P' PROJ & THRD LGTH	'L' LENGTH
90° - 65°	52 (1321)	2 (51)	6 (152)	72 (1829)

DIMENSIONS ARE GIVEN IN INCHES AND MILLIMETERS.

USR STANDARD DETAILS - SD709-047GD1
ROCK ANCHORS - RESIN DOWELS
STRAIGHT TYPE
DETAIL # 01

FOUNDATION TABLE

HOLE ANGLE FROM HORZ.	DISTANCE 'X' in	DISTANCE 'X' mm	HOLE ANGLE FROM HORZ.	DISTANCE 'X' in	DISTANCE 'X' mm
90°	18.500	470	67°	14.484	368
89°	18.447	469	66°	14.186	360
88°	18.332	466	65°	13.875	352
87°	18.236	463	64°	13.551	344
86°	18.133	461	63°	13.213	336
85°	18.022	458	62°	12.860	327
84°	17.902	455	61°	12.491	317
83°	17.775	451	60°	12.107	308
82°	17.639	448	59°	11.705	297
81°	17.495	444	58°	11.287	287
80°	17.343	441	57°	10.850	276
79°	17.182	436	56°	10.396	264
78°	17.102	432	55°	9.917	252
77°	16.832	428	54°	9.420	239
76°	16.644	423	53°	8.900	226
75°	16.446	418	52°	8.356	212
74°	16.238	412	51°	7.788	198
73°	16.020	407	50°	7.194	183
72°	15.792	401	49°	6.572	167
71°	15.553	395	48°	5.920	150
70°	15.303	389	47°	5.237	133
69°	15.042	382	46°	4.521	115
68°	14.769	375	45°	3.770	96

NOTES:

- THE ℄ OF THE PILOT HOLE STARTING POINT, AT 90° FROM HORIZONTAL, IS LOCATED ON THE BASE PLATES 18 1/2 (470) BACK FROM A REFERENCE LINE AT THE FRONT ANCHOR BOLT HOLES.
- THE ℄ OF THE PILOT HOLE MUST BE ALIGNED WITH THE SURVEY CROSS-LINE.
- AT ANGLES BELOW 90° THE ℄ OF THE PILOT HOLE STARTING POINT WILL MOVE FORWARD IN RELATION TO THE REFERENCE LINE. TO MAINTAIN ALIGNMENT WITH THE CROSS-LINE THE BASE PLATES MUST BE MOVED BACK ACCORDINGLY. THE AMOUNT OF SET BACK FOR HOLE ANGLES IS GIVEN IN THE ABOVE TABLE. THE VALUES TABLED ARE THE DISTANCE BETWEEN THE REFERENCE LINE AND THE CROSS-LINE.
- ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN INCHES WITH METRIC EQUIVALENT SHOWN IN PARENTHESIS (mm).

CONCRETE PAD NOTES:

- LEAVE 14 (356) DEEP RECESS BETWEEN CONCRETE PADS TO FACILITATE AIR SEAL INSTALLATION IN NEAR VERTICAL POSITIONS.
- CONCRETE PADS TO BE:
  90° - 70°: MIN. 14 (356) PAD
  70° - 45°: MIN. 6 (152) PAD
  OR AS REQ'D TO MAKE PAD LEVEL.
- AREA TO BE BLOWN CLEAN PRIOR TO POURING PAD. CONCRETE TO BE APPROX. 3000 PSI (21 MPa)

REFERENCE DRAWINGS

STATION LAYOUT TYPICAL APPLICATION - 40-13202

DISCLAIMER

EVERY EFFORT HAS BEEN MADE TO ENSURE THAT DIMENSIONS AND TECHNICAL INFORMATION ARE VALID AT THE TIME OF ISSUE STAMPED ON THIS DRAWING. HOWEVER, DUE TO POSSIBLE TECHNICAL REVISIONS, SOME OF THE INFORMATION ON THIS DRAWING MAY BECOME OUT OF DATE. PLEASE CHECK WITH REDPATH RAISEBORING LIMITED FOR CURRENT DATA BEFORE INSTALLATION.

7 Sep 1990

& ALL DATA
RE PROPERTY
ATH LTD.
ONT IS
& MUST NOT
T IS LOANED
ETURN UPON
OT TO BE
ANY DETRI-
R INTEREST.

Drawn BY DBH
DATE 08/03/90
CHECKED
DATE
APPROVED
DATE

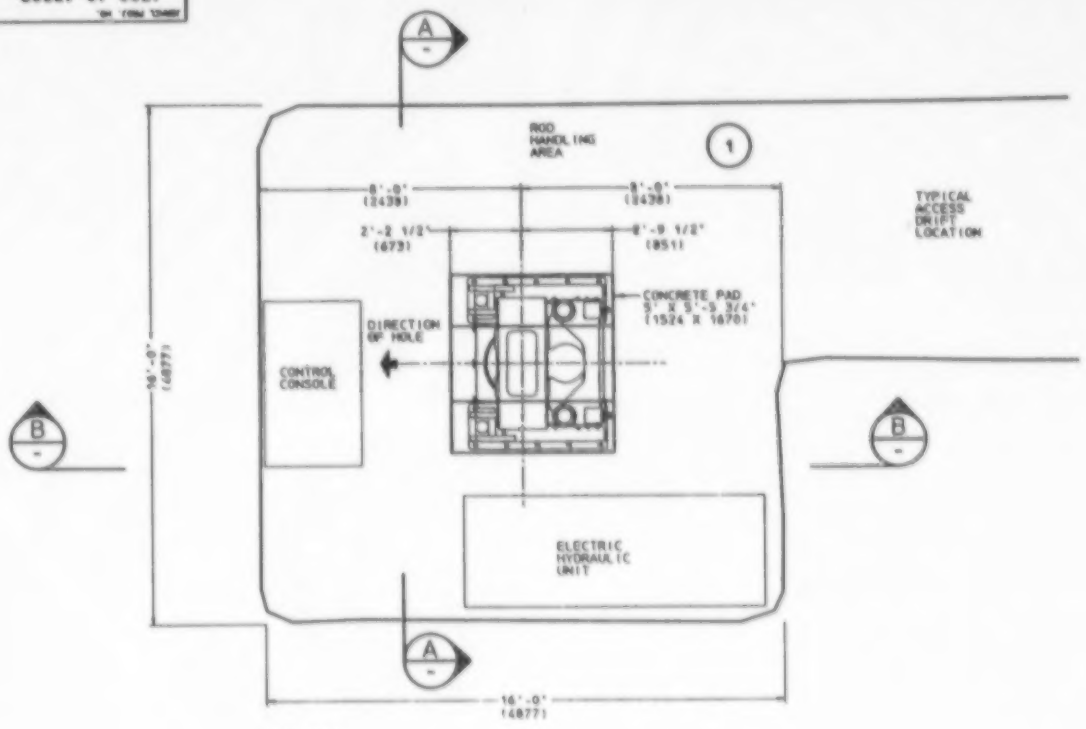
REDBORE 40

DOWN REAMING APPLICATION
FOUNDATION AND ANCHOR
BOLT LAYOUT

REDPATH RAISEBORING LIMITED

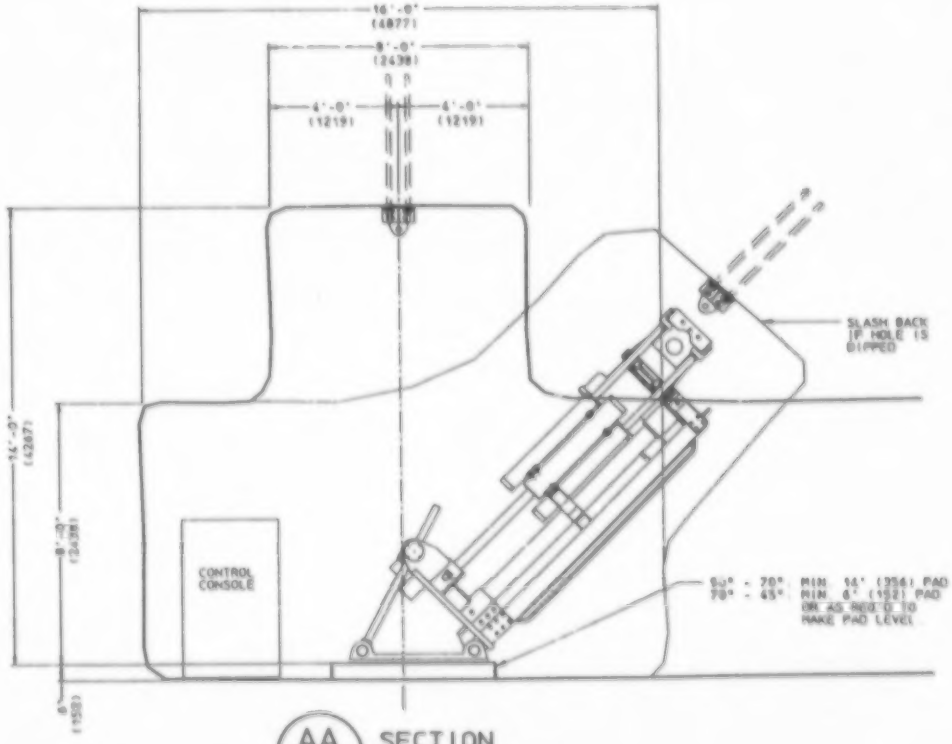
DATE MAR. '90 | SCALE AS NOTED | DWG NO. 40-13200 | REV. 0

4500-40-13202



PLAN

15 Mar 1990 08:39:21



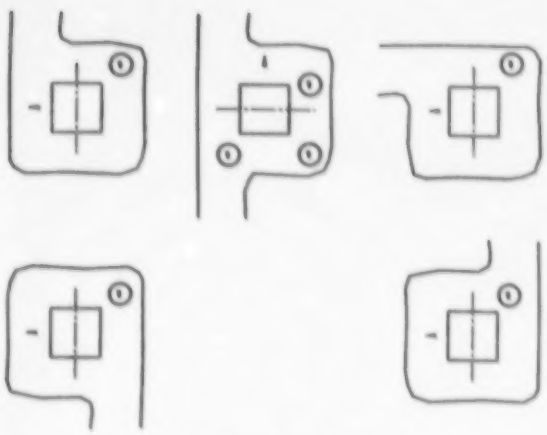
AA SECTION

15 Mar 1990 10:41:11

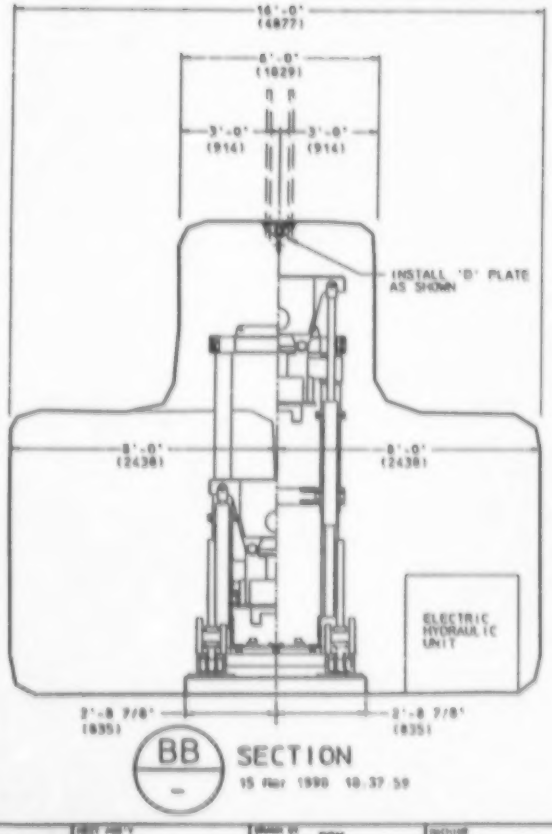
NO	REVISIONS	BY	DATE	CK'D
1				
2				
3				
4				

FINISH SYMBOLS		TOLERANCES UNLESS SPECIFIED	
125	COMMON MACHINING	WHOLE OR FRACTIONAL..... ± 1/32	
63	SMOOTH MACHINING	TWO PLACE DECIMAL..... ± .010	
32	GRIND OR EQUAL	THREE PLACE DECIMAL .... ± .005	
✓	DESCRIPTION	ANGLES ..... ± 1/2°	

THIS DRAWING & ALL DA
THEREIN IS THE PROPER
OF J.S. REDPATH LTD.
NORTH BAY, ONT., IS
CONFIDENTIAL & MUST
BE COPIED. IT IS LOA
SUBJECT TO RETURN UP
DEMAND & IS NOT TO BE
USED IN ANY WAY DETRI
MENTAL TO OUR INTERES



PLAN VIEWS OF ALTERNATE ACCESS DRIFT LOCATIONS



POWER REQUIREMENTS

550V TO 600V 3PH. - 60 CYCLE ELECTRIC POWER 150 KVA. TOTAL CONNECTION POWER OR 250 KVA. FROM DIESEL GENERATOR.
TYPICALLY 200A 3PH BREAKER.

AIR REQUIREMENTS

800 CFM.(.378 m3/s) AT 80 - 100 PSI (620 kPa - 689 kPa) PILOT HOLE DRILLING.
(DRY CUTTING REMOVAL)

WATER REQUIREMENTS

DRY CUTTING REMOVAL:
10 USGPM (38 l/min.) AT 80 - 100 PSI (414 kPa - 689 kPa) FOR DUST SUPPRESSION AND COOLING.

WET CUTTING REMOVAL:
180 USGPM (681 l/min.) AT 80 PSI (620 kPa) PLUS 550V - 3 PH - 60 CYCLE ELECTRIC POWER TO OPERATE A 25 HP, (19 KW) WATER PUMP. SUMP APPROX. 5000 USGAL. (18927 l) CAP. MAX. 75 FT. (23 m) FROM MACHINE.

ROD STORAGE (1)

SUFFICIENT AREA MUST BE AVAILABLE FOR DRILL ROD STORAGE . TOTAL AREA REQUIRED IS DETERMINED BY LENGTH OF RAISE.
8"ø X 5' (203 mmø X 1524 mm) DRILL RODS ARE NORMALLY STORED ON 4" X 6" (102 mm X 152 mm) TIMBERS STACKED TWO ROWS HIGH (3 ROWS MAX.)

DRILL RODS

8"ø (203 mmø), 60" (1524 mm) SHOULDER TO SHOULDER 450 LBS (204 kg) EACH 68" - 70" (1727 mm - 1778 mm) OVERALL LENGTH.

NOTE:

ALL DIMENSIONS GIVEN ARE STANDARD ALLOWABLE CLEARANCES FOR OPTIMUM SET UP AND OPERATION.
SHOULD YOU HAVE A REQUIREMENT FOR LIMITED ACCESS OR AN EXCAVATION RESTRICTION, PLEASE CONTACT US FOR A SPECIAL EXCAVATION LAYOUT.
DIMENSIONS GIVEN IN FEET AND MILLIMETERS.

REFERENCE DRAWING

FOUNDATION AND ANCHOR BOLT LAYOUT - 40-13200

DRAWING & ALL DATA ON IS THE PROPERTY S, REDPATH LTD., BAY, ONT., IS IDENTIAL & MUST NOT IED. IT IS LOANED CT TO RETURN UPON & IS NOT TO BE IN ANY WAY DETRI- TO OUR INTEREST.

DRAWN BY	DBM
DATE	14/03/90
CHECKED	
DATE	
APPROVED	
DATE	

REDBORE 40

DOWN REAMING OPTION
STATION LAYOUT - TYPICAL APPLICATION
FOR OPTIMUM SETUP AND OPERATION

REDPATH RAISEBORING LIMITED

DATE	SCALE	DWG. NO.	REV.
MAR. '90	3/8"=1'-0"	40-13202	0

SECTION 9.0

APPENDICES

APPENDIX 1 - MARKET SURVEY

APPENDIX 2 - MARKET SURVEY DISTRIBTUION LIST

APPENDIX 1

MARKET SURVEY QUESTIONNAIRE

QUESTIONNAIRE

Please circle the correct response, or fill in the blank.

Company Name _____

Your Name and Position _____

Property Name _____

Location _____

Are you familiar with the RB 40 raiseboring machine or have you used it to date on your property?

Familiar with:

Yes No Comment _____

_____

_____

Have used:

Yes No Comment _____

_____

_____

Does your current and future production/development forecasts include the need for (Please indicate information in either metric or imperial)

Raisebore holes (upreaming)	Length	____	____	____	____	____
	Diameter	____Ø	____Ø	____Ø	____Ø	____Ø
	Dip(range)	____	____	____	____	____
Box holes	Length	____	____	____	____	
	Size	___ x ___	___ x ___	___ x ___	___ x ___	
	Dip(range)	____	____	____	____	
Open raises	Length	____	____	____	____	
	Size	___ x ___	___ x ___	___ x ___	___ x ___	
	Dip(range)	____	____	____	____	

Alimak Raises	Length	____	____	____	____
	Size	__ x __	__ x __	__ x __	__ x __
	Dip(range)	____	____	____	____
Blind boring		____	____	____	____

Purpose of openings

Slot raise Ventilation Ore Pass Waste Pass Rockfill
Access and Service Sandfill Other _____

Does the limitation of only bottom or top end access prevent suitable openings from being constructed at your operation

Yes No Comment _____

Would it be advantageous to your operation to drill into an existing excavation and downream to a larger diameter from the collar of the hole?

Yes No Comment _____

If Yes, maximum hole diameter required ____Ø Dip(range) _____

Probable rock types _____

Probable frequency of hole installation

_____ per month _____ per year

Would a Redbore 40 on your property have a "continuous" work load for a combination of raiseboring, downreaming or blindboring given your production forecasts?

Yes No Comment _____

_____

_____

_____

Overall Comments: _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

APPENDIX 2

MARKET SURVEY DISTRIBUTION LIST

COMPANY NAME	MINE
AECL Research	Underground Research Laboratory
Agnico - Eagle Mines Limited	Donald J. Laronde Mine
American Barrick Resources Corp.	Holt-McDermott Mine
American Barrick Resources Corp.	Camflo Mine
Amok Limited	Cluff Mining
Audrey Resources Inc.	Mobrun Mine
Aur Resources Inc.	Kierens Mine
Aurizon Mines Limited	Sleeping Giant Mine
Bachelor Lake Gold Mines Inc.	Bachelor Lake Mine
Belmoral Mines Limited	Ferderber Mine/Dumont Mine
Blackdome Mining Corp.	Blackdome Mine
Bond Gold Canada Inc.	Golden Patricia Mine
BP Canada Inc.	Les Mines Selbaie
Brunswick Mining and Smelting Corp. Limited	Brunswick Mine

COMPANY NAME	MINE
Cambior Inc.	Lucien Belliveau Mine
Cambior Inc.	Chimo Mine
Cambior Inc.	Pierre Beauchemain Mine
Campbell Resources Inc.	Camchib Mines Division
Campbell Resources Inc.	Meston Lake Division
Canadian Refractories (Dresser Canada)	Kilmar Mine
Canamax Resources Inc.	Bell Creek Mine
Canamax Resources Inc.	Ketza River Mine
Canamax Resources Inc.	Kremzar Mine
Cheni Gold Mines Inc.	Lawyers Mine
Cominco	Polaris Mine
Corona Corporation	Jolu Mine
Coxheath Gold Holdings Limited	Tangier Mine
Deak Resources Corp./ GSR Mining Corp.	Kerr Mine
Dickenson Mines Limited	Arthur W. White Mine
East West Caribou Mining Limited	Caribou Mine

COMPANY NAME	MINE
Echo Bay Mines Limited	Lupin Mine
Falconbridge Gold Corporation	Hoyle Pond Mine
Falconbridge Limited	Fraser Mine
Falconbridge Limited	Kidd Creek Division
Falconbridge Limited	Lockerby Mine
Falconbridge Limited	Onaping/Craig Mine
Falconbridge Limited	Strathcona Mine
Giant Yellowknife Mines Limited	Yellowknife Division
Giant Yellowknife Mines Limited	Pamour Mine
Granges Exploration Limited	Tartan Lake Mine
Hemlo Gold Mines Inc.	Golden Giant Mine
Hope Brook Gold Inc.	Hope Brook Mine
Hudson Bay Mining & Smelting Co. Limited	Namew Lake/Callinan Mine
Hudson Bay Mining & Smelting Co. Limited	Ruttan Mine
Hudson Bay Mining & Smelting Co. Limited	Snow Lake Area Mines

COMPANY NAME	MINE
INCO Limited	Les Mines Casa Berardi
INCO Limited Manitoba Division	T1 Mine T3 Mine Birchtree Mine Thompson Mine
INCO Limited	Ontario Division
Lac Minerals Limited	Bousquet Mine
Lac Minerals Limited	Doyon Mine
Lac Minerals Limited	Macassa Division
Les Mines Dumagami Limitee	Dumagami Mine
Les Ressources du Lac Meston Inc.	Meston Lake Mine
Lynngold Resources Inc.	MacLelland Mine
Mines Abcourt Inc.	Abcourt-Barvue Mine
Minnova Inc.	Opemiska Division
Minnova Inc.	Lac Shortt Division
Minnova Inc.	Lake Dufault Division
Minnova Inc.	Winston Lake Division
Nerco Con Mine Limited	Con Mine

COMPANY NAME	MINE
Niobec	La Mine Niobec
Noranda Inc.	Geco Division
Noranda Inc.	Matagami Division
Noranda Inc.	Lyon Lake Division
Placer Dome Inc.	Dome Mine
Placer Dome Inc.	Campbell Mine
Placer Dome Inc.	Detour Lake Mine
Placer Dome Inc.	Kiena Mine
Placer Dome Inc.	Sigma Mine
Renabie Gold Mines Inc.	Renabie Mine
Rouyn Mining Resources Inc.	Francoeur Mine
Skylark Resources Limited	OB Mine
Skyline Gold Corporation	Johnny Mountain Mine
St. Andrews Goldfields Limited	Stock Township Property
Teck Corporation	Beaverdell Division

COMPANY NAME	MINE
Teck-Corona Operating Corp.	David Bell Mine
Treminco Resources Limited	Ptarmigan Mine
Westmin Resources Limited	Myra Falls Operations
Westminer Canada Limited	Gays River Mine
Westminer Canada Limited	Northgate Mines Division
Williams Operating Corporation	Page Williams Mine